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A DOCUMENTARY STUDY OF THE FELT EFFECTS OF THE GREAT CALIFORNIA EARTHQUAKE OF 1857

By Duncan Carr Agnew and Kerry E. Sieh

ABSTRACT

We have collected over 60 hitherto unpublished accounts of the California earthquake of January 9, 1857. We have used them, together with those already known, to estimate felt intensities and prepare an isoseismal map which roughly indicates the level of short-period ground motion experienced during this earthquake. Modified Mercalli intensities of VI to VII occurred in the modern metropolitan areas of southern California, and VI to VIII in the southern San Joaquin Valley. The intensity along the fault was IX or more. Instances of seiching, fissuring, sandblows, and hydrologic changes were reported from Sacramento to the Colorado River delta. Most reports say that shaking lasted between one and three minutes. At least two large aftershocks occurred within a week of the main event.

Introduction

The California earthquake of the morning of January 9, 1857, commonly called the Fort Tejon earthquake, was one of the largest earthquakes to have happened in California in historical times (about the last two centuries). This event was caused by rupture of the San Andreas fault from near Parkfield to near San Bernardino (see Figure 1), with fault slip of up to 9½ meters, the seismic moment estimated from measured offsets being about twice that of the California earthquake of 1906 (Sieh, 1978a). From the standpoint of planning for future earthquakes in southern California the 1857 earthquake is of unique importance because it is the only very large earthquake in this region for which more than the sketchiest information exists.

The importance of this earthquake has long been recognized. Published studies consist of two notes by Trask (1858, 1864); a short description in Lawson *et al.* (1908, pp. 449 to 451); the entries in the catalog of Townley and Allen (1939), drawn largely from those in Holden (1898); and an article by Wood (1955), which has been quite properly regarded as the best description of this earthquake. Unfortunately, all of these works drew upon a rather capricious selection of sources, and did not make use of all available information. This has not produced any serious errors in the general description of this earthquake, but has been responsible for considerable incompleteness and a few errors in the intensities assigned to various places.

The purpose of this paper is to document the effects of the 1857 earthquake as completely as possible by reprinting all available primary accounts of it, and to use this information to construct an isoseismal map. The collection of documents, as well as making available the information on which the isoseismals are based, contains information on long-period ground motion, duration, foreshocks (Sieh, 1978b), and aftershocks of the 1857 earthquake. The isoseismal map may serve as a guide for attempts to estimate short-period ground motion for a future large earthquake on the southern San Andreas fault.

Documentation

A list of the documents reprinted in the Appendix (on microfiche) is given in Table 1. The arrangement is by place of composition or publication for contemporary

accounts and place of description for reminiscences, the order being roughly from south to north. For brevity of citation we have assigned a number to each document. The descriptions in Table 1 are necessarily brief; full citation of each document can be found in the Appendix. Interpretation of many of these records is complicated by

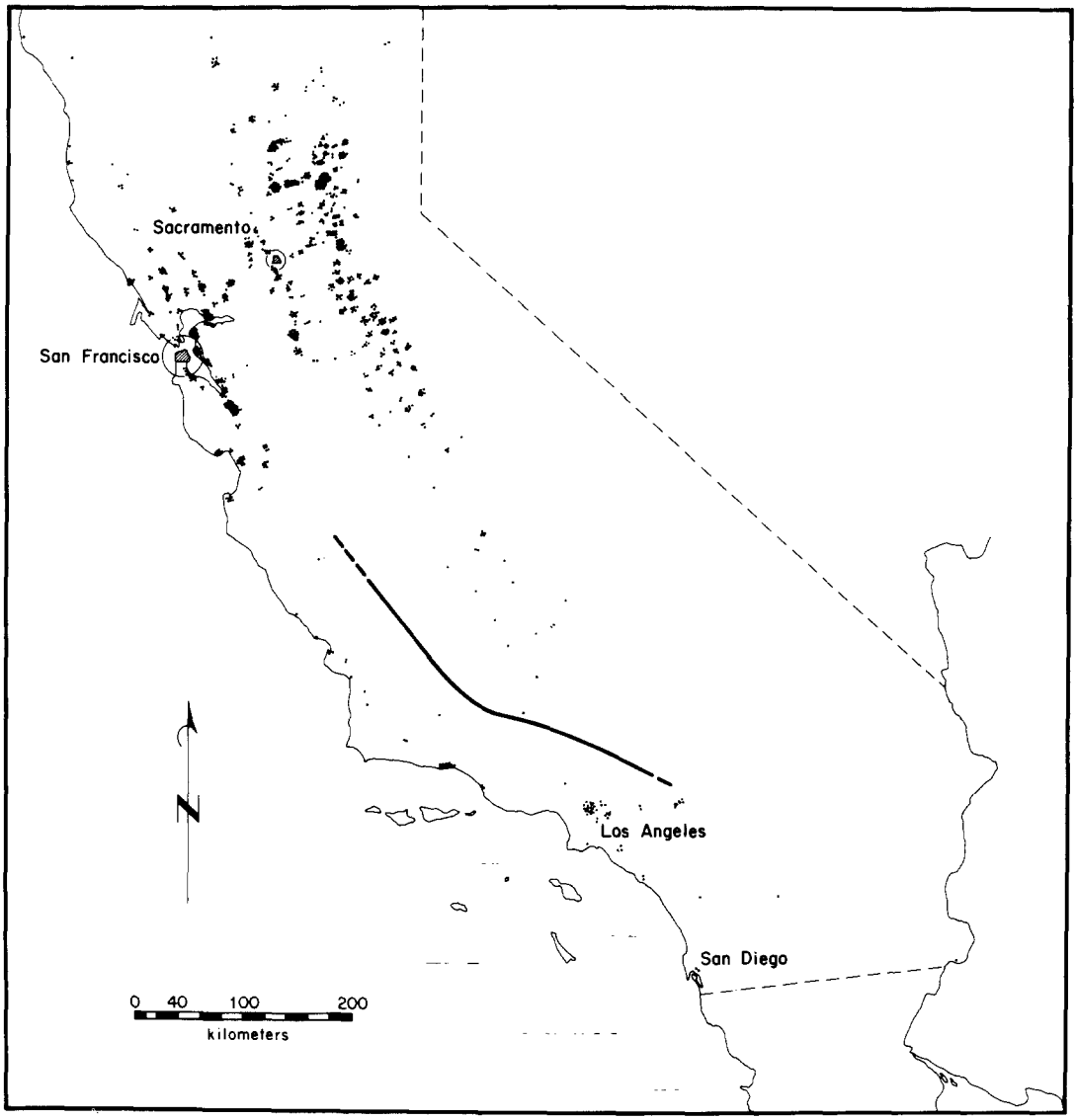

FIG. 1. Approximate distribution of the White population of California in 1860, drawn from the statistics printed for the 1860 census. Each dot represents 200 people. Open circles show the population of San Francisco (52,900) and Sacramento (12,400). In a number of areas (notably the Sierra Nevada south of the latitude of San Francisco) detailed statistics are not available, and the population has been assumed to have been in the larger towns and along the rivers, so that the distribution shown is not to be regarded as reliable in detail. The details are probably most reliable in southern California. The heavy line shows the extent of faulting in the 1857 earthquake (Sieh, 1978a).

purely historical matters such as the location of old place names. The notes appended to the accounts discuss such problems.

It is our hope, though of course we cannot be certain, that the Appendix contains all important accounts of the 1857 earthquake. Our collection of printed material

TABLE 1

LIST OF SOURCES

Number	Description	Microfiche Page
1	Letter of Albert Johnson, 3 February 1857, Colorado River	1
2	San Diego *Herald*, 10 January 1857	1
3	Journal of Andrew Cassidy, 9–16 January 1857, San Diego	2
4	Memorandum by J. Hammond, 9 January 1857, San Diego	2
5	Letters of D. M. Thomas and Amasa Lyman, 18 January 1857, San Bernardino	3
6	Journal of R. R. Hopkins, January 1857, San Bernardino	3
7	Reminiscence by Augusta Crocheron, 1885, San Bernardino	4
8	Los Angeles *El Clamor Publico*, 10 January 1857	6
9	Los Angeles *El Clamor Publico*, 17 January 1857	6
10	Los Angeles *El Clamor Publico*, 31 January 1857	8
11	Los Angeles *Star*, 10 January 1857	8
12	Los Angeles *Star*, 17 January 1857, p. 2, cols. 1–2	9
13	Los Angeles *Star*, 17 January 1857, p. 2, col. 2	11
14	Los Angeles *Star*, 17 January 1857, p. 2, cols. 3–5	11
15	Letters of H. R. Myles, 28 January 1857, Pasadena	19
16	Reminiscence by H. D. Barrows, 1906, Los Angeles	19
17	Reminiscence by Harris Newmark, 1913, Los Angeles	20
18	Letter of W. E. Greenwell, 24 February 1857, San Fernando	21
19	Letter of W. M. Johnson, 19 January 1857, Sycamore Canyon	23
20	Santa Barbara *Gazette*, 15 January 1857	26
21	Santa Barbara *Gazette*, 22 January 1857	29
22	Official Journal, 9 January 1857, Las Vegas	32
23	Letter of B. L. Beall, 9–10 January 1857, Fort Tejon	32
24	Daily Journal, 9–10 January 1857, Tejon Indian Reservation	35
25	Quarterly Report, 20 September 1857, Tejon Indian Reservation	35
26	Visalia *Weekly Delta*, 26 November 1859	35
27	Reminiscence by Stephen Barton, 1876, southern San Joaquin Valley	36
28	Reminiscence by John Barker, ca. 1900, southern San Joaquin Valley	36
29	Meteorological Journal, 9 January 1857, Fort Miller	38
30	Dairy of Dr. C. A. Canfield, 9 January 1857, near San Benito	39
31	Santa Cruz *Pacific Sentinel*, 10 January 1857	39
32	Santa Cruz *Pacific Sentinel*, 31 January 1857, p. 1, col. 5	39
33	Santa Cruz *Pacific Sentinel*, 31 January 1857, p. 2, col. 7	40
34	Santa Cruz *Pacific Sentinel*, 21 February 1857	40
35	San Jose *Telegraph*, 13 January 1857	41
36	San Jose *Tribune*, 14 January 1857	41
37	San Francisco *Daily Alta California*, 10 January 1857	43
38	San Francisco *Daily Alta California*, 13 January 1857	43
39	San Francisco *Daily Alta California*, 29 January 1858	44
40	San Francisco *Daily Evening Bulletin*, 9 January 1857	45
41	San Francisco *Daily Evening Bulletin*, 12 January 1857	46

must be nearly complete, but additional manuscript material may quite possibly still be found. Material not concerned with the earthquakes has generally been omitted from the accounts, and a number of the newspaper reports have been edited to remove scientifically useless matter such as speculations on the causes of earthquakes or remarks on the state of the weather (these omissions have in general not

TABLE 1—*Continued*

Number	Description	Microfiche Page
42	San Francisco *Daily Evening Bulletin,* 13 January 1857	46
43	San Francisco *Daily Evening Bulletin,* 3 February 1857	47
44	San Francisco *Daily California Chronicle,* 10 January 1857	48
45	San Francisco *Daily Morning Call,* 10 January 1857	49
46	San Francisco *Daily Globe,* 10 January 1857	49
47	San Francisco *Daily Herald,* 10 January 1857	49
48	San Francisco *Daily Herald,* 12 January 1857	50
49	San Francisco *Daily Sun,* 10 January 1857	51
50	San Francisco *Daily Sun,* 20 January 1857	52
51	San Francisco *Daily Sun,* 24 January 1857	53
52	San Francisco *Daily Town Talk,* 10 January 1857	53
53	Letter of George Davidson, 19 January 1857, San Francisco	54
54	Reminiscence by George Davidson, 1906, San Francisco	54
55	Paper by Dr. J. B. Trask, 30 March 1857, San Francisco	55
56	Stockton *Daily Argus,* 10 January 1857	57
57	Stockton *Daily Argus,* 16 January 1857	57
58	Stockton *Daily Argus,* 19 January 1857	58
59	Stockton *San Joaquin Republican,* 10 January 1857	59
60	Stockton *San Joaquin Republican,* 11 January 1857	59
61	Stockton *San Joaquin Republican,* 16 January 1857	60
62	Sacramento *Age,* 9 January 1857	61
63	Sacramento *Age,* 10 January 1857	61
64	Sacramento *Daily Times,* 9 January 1857	61
65	Sacramento *Daily Union,* 10 January 1857, p. 2, col. 4	62
66	Sacramento *Daily Union,* 10 January 1857, p. 2, col. 5	62
67	Sacramento *Daily Union,* 12 January 1857, p. 2	63
68	*State Year Book,* 1857, Sacramento	63
69	Marysville *Herald,* 13 January 1857	63
70	Sacramento *California Farmer and Journal of Useful Sciences,* 9 January 1857	64
71	Sacramento *California Farmer and Journal of Useful Sciences,* 16 January 1857	64
72	Sacramento *Daily Union,* 12 January 1857, p. 1	64
73	Reminiscence of Mr. Bell, 1905, Carrizo Plain	65
74	Letter of Ellen P. McGary, 9 January 1857, San Bernardino	66
75	Santa Cruz *Pacific Sentinel,* 17 January 1857, p. 2, col. 5	66
76	Santa Cruz *Pacific Sentinel,* 24 January 1857, p. 2, col. 2	66

been indicated). We have not omitted any descriptive material. Except for correcting obvious typographical errors in the newspaper articles, we have retained the original spelling and punctuation (or lack of it). One set of newspaper articles from a Spanish-language newspaper (8, 9, 10) has been translated.

In the interests of completeness we have reprinted some material that is in the

earlier published studies. The only such accounts not reprinted are those of W. F. Edgar and J. K. F. Mansfield, which are in Wood (1955) and which contain no intensity information. We have excluded secondary sources unless they contain information not otherwise available. Two of the accounts in Wood (1955) have been omitted for this reason: the material from the 1857 Coast Survey annual report, which was drawn entirely from (18) and (19), and the reminiscence of B. D. Wilson, whose correspondence (15) shows him to have been away from Los Angeles at the time of the earthquake. A number of newspaper articles referred to in earlier papers have not been included because they are simply copies of articles from other newspapers. It was common at this time for articles to be copied from newspaper to newspaper. In all cases but one (67) we have been able to use the article as first published. It should be noted that the restriction to primary sources does not mean that all the accounts are independent. In some cases they definitely are not (for example, numbers 16, 41, and 43 were all written by H. D. Barrows); in other cases this is less clear. Possible borrowings of information are indicated in the notes to the documents.

Intensity Estimates

Table 2 lists intensity estimates for those places for which they can be made, summaries of the reported effects, and references to the appropriate documents. We assigned intensities according to the Modified Mercalli scale, 1956 version (Richter, 1958, p. 137), basing our estimates mostly on human reactions and building damage. We assumed that all brick and adobe construction was weak masonry (Masonry D, in the scale classification). We excluded from our estimates effects related to long-period motion, such as seiching or ground cracking, because these commonly suggest intensities much higher than those assigned on the basis of short-period effects (see Richter, 1958, p. 138).

The table also lists places at which the earthquake was described only as felt or not felt. There are a number of places for which records (newspapers or diaries) exist that do not contain any reference to the earthquake. We have not listed these, as it is rather dangerous to draw any conclusions from them. For example, the earthquake is mentioned neither in diaries nor in the weekly newspaper in Oakland, even though (judging from the descriptions for San Francisco and Stockton) it must have been felt there.

Figure 2 is an isoseismal map drawn using the intensities listed in Table 2. Because the data are very sparse, we have shown only the boundary between intensities VI and VII and a guess at the limits of perceptibility. In drawing the VI to VII boundary we have been guided by the notion that it should be roughly parallel to the fault. We have not considered geological site conditions.

The extremely low density of population in the central and southern portions of California (Figure 1) accounts for this earthquake having caused little destruction despite its size. This low population density also makes intensity estimates more uncertain because they are based on a small sample and reporting is less complete. The estimated intensities are therefore most reliable for Los Angeles, San Francisco, Stockton, and Sacramento.

Though a detailed discussion of every assigned intensity does not seem warranted, a few points merit special examination. The first is the limit of perceptibility. There are no reports south of San Diego, no doubt because of the very low density of population in Baja California. Holden (1898) stated that the earthquake was felt at Yuma with Rossi-Forel intensity IX (Modified Mercalli VIII to IX). The source of

TABLE 2

ESTIMATED INTENSITIES

Place*	Intensity†	Description and References
Mouth of the Colorado River (31.8°N, 115.1°W)‡	V?	Shaking in boat may have been effect of seiche. (1)
San Diego	V	Many frightened, some objects upset. (2, 3)
San Bernardino	VI	All frightened, trees shook, houses cracked. (5, 6, 7, 14, 74)
San Gabriel Valley	VII	Men thrown down, many houses cracked and some badly damaged. (14, 15)
Los Angeles (downtown)	VI	All frightened, many ran outdoors, difficult to stand, some objects upset, some houses cracked but none badly damaged. (8, 9, 11, 14, 16, 17, 41)
San Fernando Valley	VII	Difficult to stand, trees shaken violently, houses badly cracked and two collapsed, (14, 18)
Upper crossing of the Mojave River (34.6°N, 117.4°W)‡	VII	Difficult to stand, described as stronger than at San Bernardino. (14)
Sycamore Canyon (34.08°N, 119.02°W)	VII	Difficult to stand, camp gear upset. (19)
Ventura (San Buenaventura)	VII	All ran outdoors, buildings cracked and some collapsed. (19, 20)
Santa Barbara	VI	All ran outdoors, buildings cracked, none severely. (19, 20, 38, 39, 48)
San Andreas fault (Mill Potrero to Lake Hughes)	IX or more	Houses, trees, cattle, and people thrown down. (14, 17, 21, 43, 57, 61)
Fort Tejon (34.88°N, 118.90°W)	VIII	People thrown down, all buildings damaged, some severely. (23, 57)
2 km SE of Fort Tejon	IX	House collapsed, tree thrown down. (21)
Tejon Indian Reservation (35.04°N, 118.67°W)	VII–VIII	Most buildings damaged, one collapsed. (14, 24, 25, 43)
Kern River Valley (35.4°N, 119.0°W)‡	VII–VIII	Men and camp gear thrown down, trees uprooted. (21)
White River (35.9°N, 119.3°W)‡	V–VI	Hard to stand, trees shaken. (58)
Tulare Lake (36.3°N, 119.7°W)‡	VI–VII	Limbs shaken off trees. (28)
Visalia	(V–VI)	Most people badly frightened, some sick, trees shaken. (27, 58, 59)
San Benito River (36.7°N, 121.3°W)‡	VI–VII	Hard to remain seated, some masonry fell. (30)
Rancho San Benito (36.2°N, 121.0°W)‡	VI–VII?	All ran outdoors, no damage reported. (34)
Salinas River (36.4°N, 121.5°W)‡	VI	Many frightened, trees shook. (33)
Monterey	IV?	Not felt by many, direction estimated, no damage. (41)
Santa Cruz	V	Not felt by some, duration estimated, clocks stopped, trees shaken, possibly slight damage. (31, 32, 75)
San Jose	IV–V	Many frightened, some sick, no damage mentioned, direction estimated. (35, 36)
San Francisco	II to V	Felt by few on hills; on lower ground many alarmed, clocks stopped, crockery rattled, some objects thrown down. (37, 40, 44, 45, 46, 47, 49, 52, 53, 54, 72)

* Coordinates are given for those places for which no current place name could be used.

† A range of intensities is given if the estimate is somewhat uncertain; a question mark indicates estimates that are particularly uncertain because of lack of information.

‡ A double dagger indicates those locations that are not well determined.

his statement is unknown. Neither the diary of a ferryman at Yuma (Beattie, 1929), nor the weather records kept at Fort Yuma (in the Climatological Records series, Record Group 27, U.S. National Archives) mentions the earthquake. Our one source for this area (1) describes a seiche near the mouth of the Colorado River (which would strictly speaking be intensity I) and possibly shaking of intensity V. Holden's intensity is very probably incorrect. There is a definite report (22) of the earthquake from Las Vegas. To the northeast of the fault, we have definite statements (51, 55) that the earthquake was not felt anywhere east of the northern San Joaquin and Sacramento valleys, and we have found no good reports to the contrary (see 67, and the note thereto). The northern limit is said to have been near Marysville (51); though it would seem that the earthquake must have been felt along the coast north of San Francisco, we have found no reports of it.

The intensity along the fault must have been IX or more since trees 20 km west of Fort Tejon were overthrown and buildings were destroyed between Fort Tejon

TABLE 2—*Continued*

Place*	Intensity†	Description and References
Stockton	IV	Lamps swung, windows rattled, some people dizzy. (56, 59)
Stockton-Sacramento road	VI	All frightened, furniture overturned, limbs shaken off trees. (63)
Sacramento	V	Felt by most, frightened some, clocks stopped, doors swung, crockery rattled, direction estimated, a few walls cracked. (42, 49, 62, 64, 65, 66, 68, 70)
Felt:		
Carricito (10)		Point Conception (20)
(San Diego County?)		
Point Arguello (21)		Santa Cruz Island (20)
Santa Rosa Island (21)		Santa Catalina Island (21)
Las Vegas (22)		Marysville (69)
Fort Miller (29)		
(37.01°N, 119.67°W)		
Not felt:		
Mokelumne Hill (50)		
Mariposa (55)		
Downieville (55)		

and Elizabeth Lake. One of two fatalities reported for this earthquake was at Gorman, where a woman was killed by the collapse of an adobe house. At Fort Tejon, 7 km from the fault, none of the buildings were totally destroyed; of seven that had been completed, two were so badly damaged as to be unsafe, and half of the six under construction were seriously damaged, the rest less so (23). These buildings had timber framed roofs and adobe bearing walls (Cullimore, 1941). The reports indicate intensity VIII for this location.

The intensity in the southern California metropolitan area was VI to VII (Figure 3). In the pueblo of Los Angeles (the present downtown), descriptions seem to fit intensity VI very well. The population was badly frightened but there was no damage to buildings other than cracking (9, 14). The descriptions of effects in San Bernardino and Santa Barbara seem to match those in Los Angeles. In the San Gabriel and San Fernando valleys, and in Ventura, the intensity seems to have been greater, as some buildings collapsed, and we therefore have assigned intensity VII

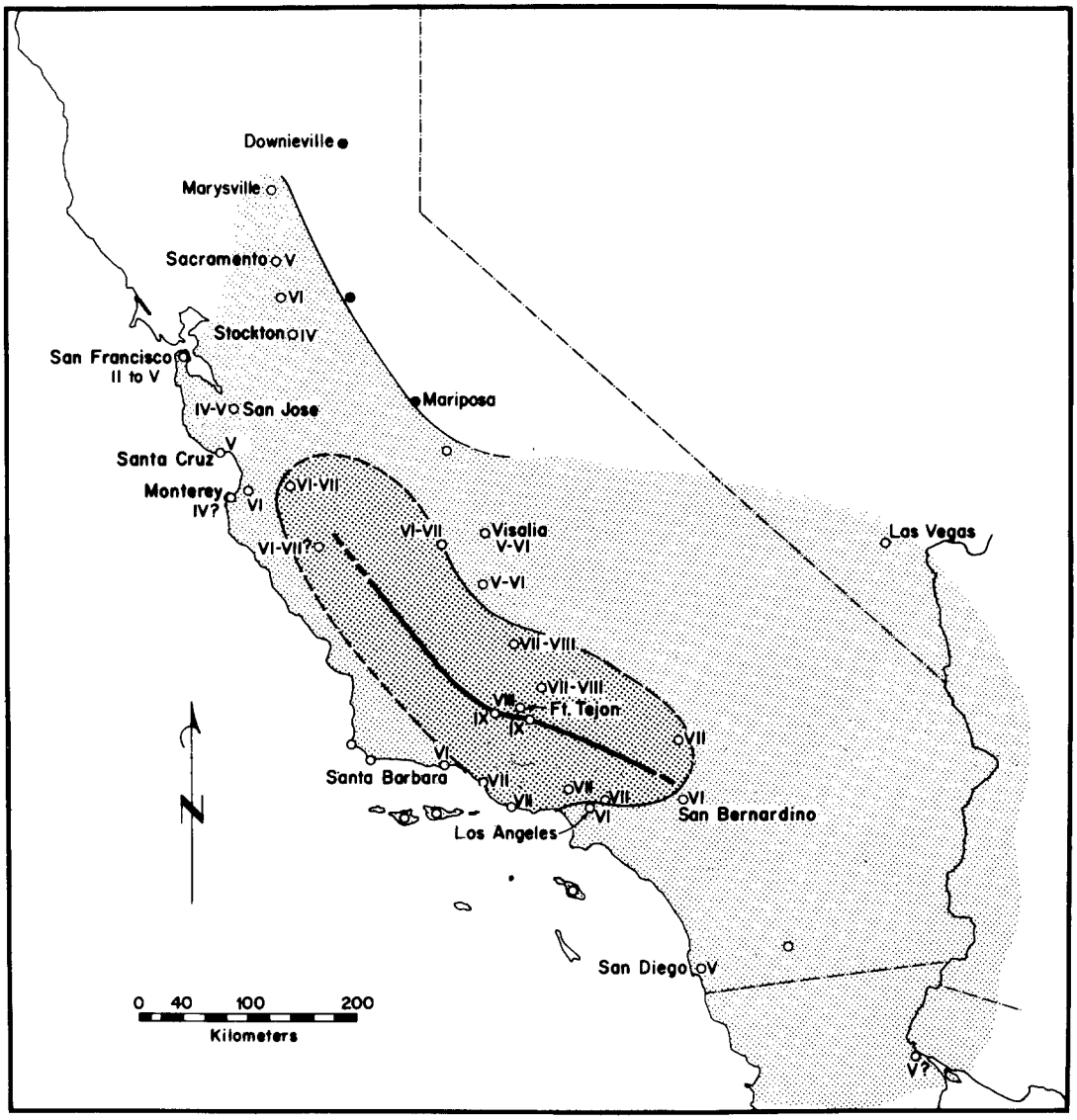

FIG. 2. Isoseismal map for the California earthquake of January 9, 1857, based on the intensity estimates in Table 2. Open circles with an accompanying Roman numeral are places for which an intensity has been estimated using the Modified Mercalli scale, 1956 version. Other open circles show places at which the earthquake was only reported as felt, and filled circles places at which it was not felt. The heavy stippling indicates the approximate area of damaging intensities (VII or more). The lighter stippling shows the area of lower intensities. The limit of perceptible shaking is unknown except between Mariposa and Marysville.

to these places. Nowhere in this area does there seem to have been such a proportion of destroyed buildings as to justify an assignment of intensity VIII.

LONG-PERIOD EFFECTS

Some accounts of the earthquake (5, 9, 41) describe the motion of the earth as being different from that in previous earthquakes, and many (9, 16, 35, 40, 41, 58, 70) specifically state that the motion was long and slow. [Although one account (18) says just the contrary.] We believe that these statements may reflect a high level of long-period motion from this earthquake. Such effects as seiching, fissures in the

ground, and changes in the flow of wells or springs seem to have been widespread. We summarize reports of these effects here.

Seiches in rivers were reported from the Colorado River at the head of the Gulf of California (1), the Los Angeles (14, 41), Kern (21), and Sacramento (64) Rivers, and the Mokelumne River near Thornton (63). At the last place the riverbed was said to have been left almost bare, even though the river was bank full. This could reflect large ground motion, resonance, or exaggeration. Substantial seiching occurred in Tulare, Kern, and Buena Vista Lakes in the southern San Joaquin Valley (14, 23, 28, 58) and in a small lake near Stockton (60). Seiching, sometimes severe, in irrigation ditches and artificial basins occurred in Los Angeles (8, 16, 41), San Bernardino (6), Santa Barbara (20), and Sacramento (68).

Fissuring of the ground was reported to have taken place in the beds of the Los Angeles (9, 14, 43), Santa Ana (43), and Santa Clara (19) Rivers, and at Santa

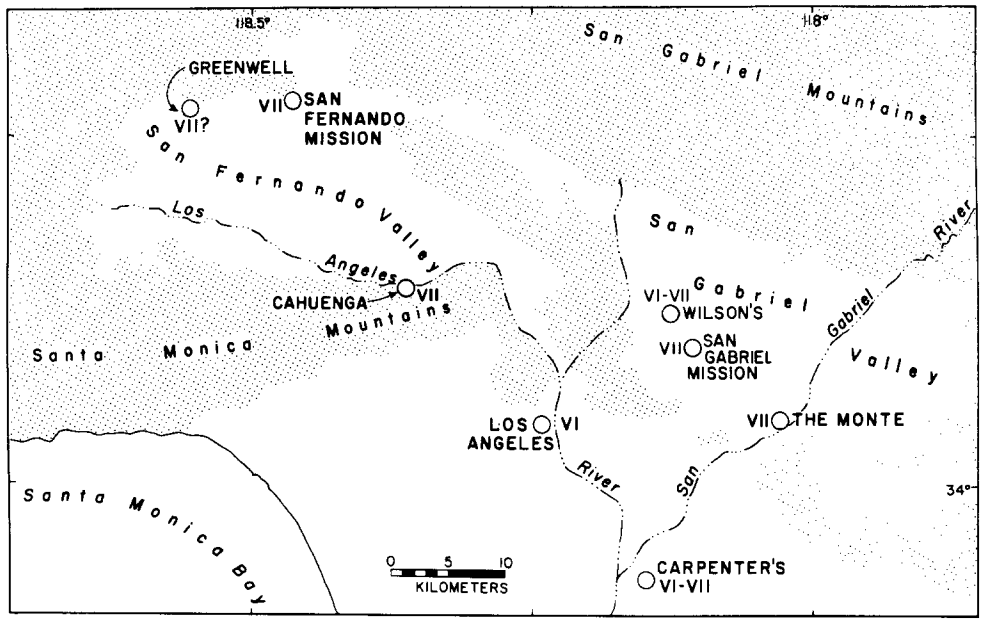

FIG. 3. Intensities of shaking near Los Angeles, including the San Gabriel and San Fernando Valleys (see Table 2 for sources). The stippling indicates lack of alluvial cover. The intensity throughout this region seems to have been in the range VI to VII.

Barbara (38). Ground cracks reported for the San Bernardino area (5, 7) can be located precisely enough to exclude the possibility that they developed on the Claremont fault (in the San Jacinto fault zone). Sandblow activity was reported at Santa Barbara (38, 39) and in the floodplain of the Santa Clara River (19). There is a description of sunken trees, possibly associated with liquefaction, in the area between Stockton and Sacramento (63).

Changes in stream or spring flow were reported from the vicinities of San Diego (3), Santa Barbara (39), Isabella (26), and at the southern end of the San Joaquin Valley (14). Water began flowing in a formerly dry arroyo in the San Fernando Valley, probably Limekiln Canyon (18). A burning petroleum seep (miscalled a volcano) west of San Fernando became active (14, 18). Changes in the flow of wells were reported (35, 36, 71) from the Santa Clara Valley in northern California (note that this is not the same as the Santa Clara River mentioned above).

Duration

Figure 4 shows the estimates of duration reported for this earthquake. Though these estimates are quite diverse, most of those that were made in areas where the shaking was strong fall in the range from 1 to 3 min. Farther from the fault the estimates are more scattered, perhaps because of the difficulty of estimating duration when the motion is gentle. Two estimates of duration longer than 10 min are undoubtedly due to the inclusion of immediate aftershocks.

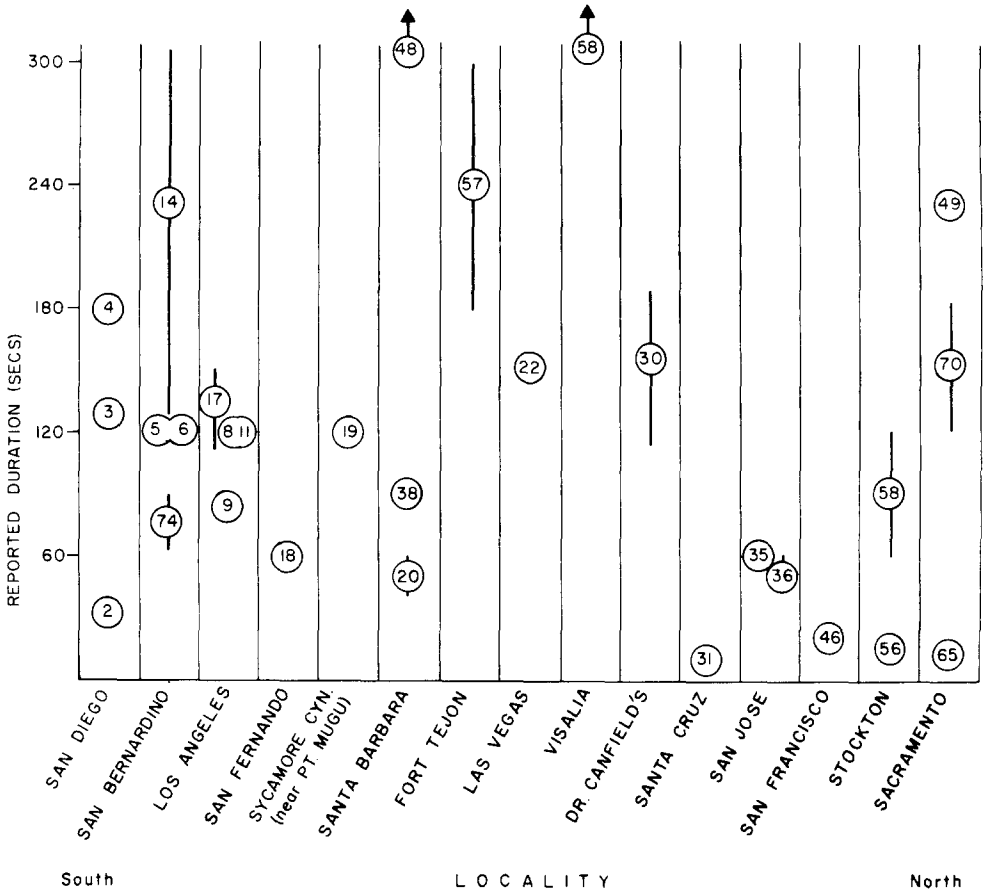

FIG. 4. Reported duration of shaking. Only independent accounts are plotted here. The numbers show in what document a duration is reported. A vertical line indicates that the duration was stated to be in some interval [e.g., in (57) the shaking at Fort Tejon is said to have "lasted from three to five minutes"]. Two reports gave durations of more than 5 min, but most indicate a duration between 1 and 3 min.

Aftershocks

Many of the documents printed here mention shocks following the main event, but our collection of sources should not be regarded as complete in this respect, even for the month of January. It should also be remembered that the unevenness of geographical coverage means that some quite large aftershocks could have escaped mention. There are no regular sources of information (such as newspapers or diaries) from Santa Barbara to Santa Cruz. A magnitude 6 event in the Parkfield-

Cholame area, for example, would have caused shaking of intensity IV or less in these places, which might well not have been reported.

Most of the aftershock reports that we do have cannot be correlated from one account to another. Though this lack of consistency may often be owing to inadequate timing, vagueness of description, or the varying degrees of diligence with which different people kept records, it may also indicate that most of the aftershocks were small. In particular, the general lack of correlation between the accounts of the Coast Survey parties at San Fernando (18) and Sycamore Canyon (19) would seem more likely to have been owing to differences in the shocks felt than to inaccurate or inadequate observation.

Two aftershocks apparently were large enough to have been widely reported. One at about 10:30 or 11 p.m. on the January 9 was reported from Cajon Pass (14), Los Angeles (9, 14), Sycamore Canyon and Ventura (19), Visalia (58), and Sacramento (65). It was described as "severe" at Sycamore Canyon, but does not seem to have been destructive anywhere, except perhaps Fort Tejon (23). The reports are consistent with a large event northwest of Tejon Pass. The other widely reported aftershock was at about 5 p.m. on January 16; it was reported from San Diego (3), San Bernardino (6), Los Angeles (9, 13), and Santa Barbara and Castaic Junction (20). In Los Angeles and San Bernardino it is described as being as strong as the main event but shorter; intensity V might be a good guess for these places. Comparison of the reports with those from historical events of known magnitude suggests a magnitude of about 6 and a location between Tejon Pass and Cajon Pass.

Conclusion

Perhaps the most interesting conclusion that can be drawn from this study is that the intensity was not extremely high in the Los Angeles area. We feel that the evidence justifies the conclusion that were the 1857 earthquake to be repeated today there would not be extensive damage to low-rise construction in the metropolitan Los Angeles area. The evidence does suggest that there would be substantial damage to structures located along the fault. The numerous reports of seiching and fissuring afford no quantitative basis for estimating long-period motions but imply that they were large. Estimates of duration suggest that strong shaking must have lasted for more than 1 min. At least two of the many reported aftershocks must have been large enough to be locally damaging.

Acknowledgments

We owe particular thanks to Dan Burd, who searched through a great number of possible sources in order to find many of those that we have used here.

Many historians and librarians have helped us in our search for information. We gratefully acknowledge the help of W. Harland Boyd, Lori Davisson, the late Maynard Geiger O.F.M., Roberta Nichols, Virginia Rust, Marilyn Seifert, Helen Uliberry, Richard S. Whitehead, and members of the staffs of the Bancroft Library, the California State Library, the Historical Department of the Church of Jesus Christ of Latter-Day Saints, the National Archives, the Periodical Division of the Library of Congress, and the Serra Museum Library. Laurie Sieh, Carlos Salvado, Alejandro Nava, and George E. Agnew helped produce our translations from the Spanish. We offer special thanks to Clarence Allen and Rodman W. Paul, who provided the encouragement to begin this project.

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INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS
SCRIPPS INSTITUTION OF OCEANOGRAPHY
UNIVERSITY OF CALIFORNIA, SAN DIEGO
LA JOLLA, CALIFORNIA 92093 (D.C.A.)

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA 91125 (K.E.S.)
CONTRIBUTION NO. 3055

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APPENDIX

Original documents and notes concerning the California earthquake of 1857 are reproduced on microfiche and are enclosed in the backpocket of this issue of the *Bulletin.*

Original Documents and Notes

1. Portion of a letter from Albert Johnson to "Mother and all", February 3, 1857 (Johnson Papers, Arizona Historical Society, Tucson, Arizona)

I must tell you about the earthquake we had down the river. We were tied up along the bank waiting for the vessel one day.[1] Alonzo was in the aft-cabin and Mr. Neah and the second engeneer and myself were in the cabin, when all at once the boat began to rock. The tide was on the ebe and we thought that it was the boat slipping off the bank. Just then Alonzo came in and sad there was an earthquake. We all ran out. The boat rocked so that we could hardly stand. We looked up the river and the water all drawed off of one place and left it dry. Then in a moment all rushed back again foming and tumbling. That was the only earthquake I ever saw on the river.

Notes

1. Unfortunately neither the time nor place of observation is given, but we can make some inferences about them. Another portion of Johnson's letter shows him to have been aboard a river steamboat. It would appear that the steamboat was waiting to pick up supplies from an ocean-going ship at the mouth of the Colorado River (for a discussion of this river trade, see Sykes, 1937). That this is consistent with a date of January 9 is confirmed by the diary of Louis Jaegar at Yuma (Beattie, 1929), which says that a steamer went down the river January 2 and returned January 21, having picked up supplies from "the vessel". The most reasonable location for Johnson is that one at which Ives (1861) said he found the steamboats waiting in December 1857, a point 15 miles above Robinson's Landing. Comparison of the maps in Sykes (1937) leads to the location in Table 2.

2. San Diego *Herald* January 10, 1857 p. 2

Our city was visited with a slight shock yesterday, (Friday) morning, at half past 8 o'clock. It lasted about half a minute, and appeared to pass from east to west.— Considerable alarm was manifested by a few of our citizens, and many seats around breakfast tables were vacated without a request to leave. At the storehouse of C. Gerson, several articles of merchandize were thrown from the shelving. The shock, so far as we have been able to learn, was unattended by any noise or other signs of premonition.

3. Extracts from MS Meteorological Journal of Andrew Cassidy, January 1857 (Cassidy File, Serra Museum Library, San Diego)

[January 9][1] At 8^h 50^m A.M.[2] a shock and vibrating motion from N.E. to S.W. lasted two minutes & 10 seconds felt at this place.
[Undated] Since we have had the shock on the 9^{th} the spring of water in this vicinity discharge about three times the amount they did before. One in particular about fifteen miles from this place which discharges treble if not more.
16^{th} A shock felt here at 5^h 10^m P.M. lasted 0^h 1^m 20^s – apparently horizontal motion E. to W.

Notes

1. The first two entries are not dated; the first one is on the line for January 9. Lack of adequate space results in each entry running over several lines and therefore several days.

2. This time is exceptionally bad, especially since Cassidy, according to an 1853 entry in his MS notebook "Miscellaneous Notes on the Tide Gauge . . . at San Diego, Cal" (Cassidy File, Serra Museum Library), had a chronometer which was kept set to San Diego mean time.

4. Record of Dr. John S. Hammond, San Diego, as provided to Benjamin Hayes (p. 908, Hayes MS "Pioneer Notes", Catalog No. CE 62 (Phot), Bancroft Library, Berkeley)

January 9^{th}, 1857, 8^h 31^m A.M.
Horizontal oscillatory earthquake moving N. and S. with a rumbling noise. The duration was about three minutes.

5. Portion of a letter from D. M. Thomas, January 18, 1857, San Bernardino (In MS "History of San Bernardino", compiled by Andrew Jenson, Historical Department, Church of Jesus Christ of Latter-Day Saints, Salt Lake City)

On Friday morning, the 9 inst., about 8 o'clock, we had a very severe shock of earthquake. The vibration continued about two minutes; the motion was from north to south, and apparently undulating. Many of the people ran out of their houses. It was accompanied with a rumbling noise, and produced a sensation of giddiness, and some were sick similar to sea sickness; every thing (houses, trees, cattle and people) had the appearance of being drunk. I have felt many shocks before but this was different and caused a sensation unlike any I have ever experienced...There has been more or less vibration every day and night since. On last evening we had quite a shake of the regular kind. There is quite a fissure caused by the earthquake in the western part of the city...[1]

At the Monte and Los Angeles the shock was about the same as felt by us here...

Portion of a letter from Amasa M. Lyman, January 18, 1857 (In MS "History of San Bernardino", as above)

...We have a succession of shocks of earthquakes, which have, in our locality, raised more excitement than they have done real damage...

Notes

1. See (7), note 1.

6. Extracts from MS Journal of San Bernardino Mission, kept by R. R. Hopkins, official recorder, January 1857 (Catalogue #1421, Historical Department, Church of Jesus Christ of Latter-Day Saints, Salt Lake City)

Friday 9 At 25 minutes past 8 o'clock this morning our city was visited with a violent Earthquake which crack the walls of most of the Houses in the place the water in the stream was violently agitated and thrown several feet high. The trees swayed to and fro as if in a strong gale, though the air was calm. There was two shocks the first lasted two minutes and in about ten minutes there was a second shock not so violent which lasted about one minute.
Saturday 10 ...Last night there was two quite severe shocks, though not so severe as yesterday.

Tuesday 13 ... The Earth oselates slightly though preceptible every day.
Friday 16 At 15 minutes of five o'clock p. m. we had a very severe shock of an Earthquake though short. The house shook peceptably for a minute. The Inhabitants of the City fled from the houses to the Street.
Saturday 17 ...The Earth quakes slightly throughout the day & night.
Monday 19 ...There was several slight Earthquakes yesterday & last night.
Saturday 31 There was a severe Earth Quake ~~last night~~[1] at 10 minutes past one o'clock pm accompanied with loud reports similar to the discharge of Cannon. The reports were in the mountains.

Notes

1. These words are crossed out in the original.

7. Reminiscence by Augusta J. Crocheron (From Crocheron, 1885, pp. 371-372)

Can any one who has ever experienced an earthquake, overcome a dread of its recurrence; or mistake the signs that are usually premonitors of its coming? One pleasant morning I was searching through garden paths for roses for the breakfast table, when the air seemed to hold still, not a breath stirring. I heard a far off smothered, rumbling sound, that I scarcely noticed, for I thought I was growing dizzy, and not understanding why I should feel so, I started for the house. As I stepped across a narrow stream, the opposite bank seemed first to recede from me, then instantly to heave upward against my feet. As this threw me from my equilibrium, the water emptied out on either bank, and hearing an Indian's voice in loud supplication, I turned and saw our Lothario on his knees, the ground rising and falling in billows around him. At the same instant I saw my parents and sisters clinging to large trees, whose branches lashed the ground, birds flew irregularly through the air shrieking, horses screamed, cattle fell bellowing on their knees, even the domestic feathered tribe were filled with consternation. Voices of all creatures, the rattling of household articles, the cracking of boards, the falling of bricks, the splashing of water in wells, the falling of rocks in the mountains and the artillery-like voice of the earthquake, and even that awful sound of the earth rending open — all at once, all within a few seconds, with the skies darkened and the earth rising and falling beneath the feet — were the work of an earthquake. It passed — we rejoined each other, thankful that life was spared, and looked around with trembling, upon the scene, where utmost terror had reigned. Said father, it is scarcely time to congratulate ourselves, another shock may occur in half an hour. In

suspense we waited, and it came. Then the skies cleared, the air moved with cool, swift wings, the stream ran clear, and the earthquake's spell had passed. When we ventured to walk around at a little distance from the house, we found, about twenty rods away, a rift in the solid ground, a foot wide, a hundred feet long, and so dark and deep, we feared even to measure it.[1]

Notes

1. This is very probably the crack mentioned in (5). Crocheron (1885, p. 340) says that their farm lay on the edge of Lytle Creek, which is west of San Bernardino. According to Beattie and Beattie (1939, p. 303), Augusta J. Crocheron was the daughter of Caroline and Alden A. M. Jackson. The deeds registered in the San Bernardino County Recorder's Office show one land purchase by Alden A. M. Jackson before 1857, of "five acre lots number One, Two, Three, and Twenty-Eight in Block number Twenty Four" and "lot number Nine in Block Sixteen" (deed of November 17, 1855, Deed Book A, pp. 106-107). The maps in the Recorder's Office (particularly Map Book 7, pp. 1-3, and Map Book 2, pp. 9, 26, and 65) and the maps in Raup (1940) show the latter parcel to be near 2nd and Sierra, on the east side of town and not near Lytle Creek. The lots in block 24 fall within a rectangle measuring 388 meters north-south by 314 meters east-west, and bounded on the east by Mount Vernon and on the north by 5th. This area does border on Lytle Creek. It is interesting to note that the crack could not have coincided with the active Claremont fault as shown by Sharp (1972) and Sieh *et al.* (1973).

8. Los Angeles *El Clamor Publico* January 10, 1857 p. 3, col. 1

At 8 o'clock yesterday morning an earthquake of great strength and duration, lasting about two minutes, was felt here. The undulation of the earth was from north to south. The inhabitants fled from their houses in terror and gathered in the streets. No one has been injured and only some houses were cracked. This earthquake was not as strong as last year's, but it lasted much longer. Very strange phenomena were seen: water sloshed out of troughs and flocks of birds, screeching loudly, followed the motion of the earth as if impelled by some invisible force.

Earthquakes seem to be the order of the day. Yesterday afternoon and tonight there have been other tremors of different strengths. Some say that six earthquakes have been felt in less than 24 hours, which has not happened here before.

9. Los Angeles *El Clamor Publico* January 17, 1857

THE EARTHQUAKE

The first shock started at 8 in the morning and lasted between 80 and 90 seconds. It began very gently, became strong, and was a little less strong when it ended.[1] The ground immediately around us seemed to shake violently like a cradle rocking. Only rarely do earthquakes last so long and have such strange motions.[2] The water standing in pools was thrown about and splashed over their edges. The water in the ditches around the village was also thrown about and over the banks, and from being crystal clear became thick with mud. Dogs howled and the beasts stood like statues while flocks of startled birds flew shrieking from south to north as if moved by an invisible force. The people fled into the streets; many could not stand and in terror fell to their knees and cried out, "Lord have mercy", The houses cracked and if they did not have light roofs of asphalt would have fallen in, which would have made this earthquake as destructive as the one in San Salvador in Central America. Many people were nauseated. Along the banks of the creek near here the earthquake has produced long open cracks of varying width. A few minutes after 8 there was another earthquake which lasted for a short time. At 11 at night there was a third shock which lasted 4 seconds; during the night three more were felt, making a total of six that were noticed by most people. There is also another phenomenon. From the first shock at 10 A.M. until five P.M. the earth has been moving constantly, though it has required close attention to notice this. There have certainly been more than a few periods, up to 20 minutes long, of almost imperceptible earthquakes. It seemed as though the Earth,

tired of suffering our sins, was shaking herself free of us as birds shake off what disturbs their feathers.

The day before the shock the clouds collided with each other, as if in aerial combat. One lady, seeing this, predicted that something was about to happen in the earth. Even the cocks' crows have seemed prophetic. For the last four or six weeks we have seen a new kind of white and dusty fog that has never appeared before. Some people who have spent time in it say that it stays in one's hair like flour or ashes. If I am not mistaken, some silent air currents have been passing over us, which have influenced even if they have not caused these earthquakes.

We hope these phenomena will be studied by naturalists. They should bear in mind that last winter (1855-56) there was so little rain that the fields were not covered with vegetation, and that this winter was very late, the first rains not falling until December 28 instead of October or November as is usual. There is reason to believe that in this region the Earth's surface is underlain by layers, or perhaps deep streams, or great pits of asphalt, as is shown by the springs and seeps of this mineral found in this area. The earthquakes began after 12 days of rain (counting from December 28th to the 8th of this month), as if they had been produced by an alteration of the elements, the long drought being ended by the rains.

On the night of the 9th and 10th, three more shocks were felt, though all were brief. The aspect of things remained threatening.

The news we have received from other areas is that the earthquakes were felt even far from here. At Fort Tejon, 35 or 40 leagues from here,[3] the shocks were much stronger. The earth opened up for 3 miles, swallowing up a grove of oaks and forming a large trench. Some houses fell, one killing a woman. In San Buenaventura, 26 leagues from here,[3] the church suffered much damage and part of the tower fell.

Yesterday at 5 P.M. another earthquake was felt. It was nearly as strong as the first one but did not last as long.[4]

Notes

1. In the original, "A las 8 de la mañana comenzó el primero que durò entre 80 a 90 segundos, poco sensible en su principio, fuerte en su medio, y un poco menos fuerte en su conclusion".

2. In the original, "Un temblor de tanta duracion y extraño movimiento pocas veces se esperimenta."

3. The airline distance from Los Angeles to both Ventura and Fort Tejon is about 100 kilometers, or 21 leagues (for a league of 3 statute miles). The distances given here

must therefore be measured along the road. The route to Fort Tejon (see 21, n. 1) was rather roundabout.

4. In the original, "Fué casi tan fuerte que el primero, aunque no de tanta duracion."

10. Los Angeles *El Clamor Publico* January 31, 1857 p. 2, col. 3

. . . A person who just arrived from Sonora informs us that on Friday, January 9th, he felt a strong earthquake in the Carricito[1] some 200 miles from this city. This means that on that day an earthquake was felt all over California.

Notes

1. We have not been able to identify this place. It is not even clear whether Sonora refers to the Mexican state or the mining town in the Sierra Nevada. The former is more reasonable, as Carricito could refer to either the Carrizo Creek area southeast of Borrego Springs or Carrizo Creek southeast of Lake Henshaw. Either Carrizo Creek location is consistent with the distance given, which is presumably measured along the road (see 9, n. 3).

11. Los Angeles *Star* January 10, 1857 p. 2

Yesterday morning, about half-past eight o'clock, a very severe shock of an earthquake was felt here, the vibrations continuing for fully two minutes. The motion was from North to South. During the day as many as four or five shocks were experienced, but all less intense than the first. Several houses were slightly cracked by the first shock, but no material damage was sustained. Doors were slammed to and fro, water was turned out of bowls and pitchers, and in the river the water rushed violently to one bank and then back again, the motion being repeated several times. In some places the earth is represented as having undulated as a field of wheat moved by the wind. It caused a general turn out, some rushing from their beds without stopping to dress.

An infinite variety of incidents are related of the effects of the shock, some amusing, others astonishing — but all such as are likely to take place when people are tolerably well frightened.

12. Los Angeles *Star* January 17, 1857 p. 2, col. 1-2

Elsewhere we have given ample details of the effect of the late convulsion of nature by which we have been visited. Here, we do not intend further to refer to that matter; but as the subject has been the great topic of conversation during the week, and reference made to the frequency of earthquakes here, and the great danger we were all subject to, in being engulphed by one of those visitations, we have taken some trouble to inform ourselves on the subject generally, and we have come to the conclusion that no great danger need be apprehended from earthquakes in this country — judging of the future by the past, and we suppose the laws of nature will not be materially departed from, either to punish or reward the new race which now possesses the land.

Regarding the history of earthquakes in this part of California, as a matter in itself well worthy of investigation and record — apart from its present overwhelming interest — we have sought information on the point from a gentleman well versed in the history of his country — Don Jose Antonio Carrillo, who was born in San Francisco April 1796, and has resided here ever since, except when completing his education in the city of Mexico, and afterwards when representing his native State in the National Congress. During this long period, there have been but two earthquakes of a more serious character than those experienced here lately, and no tradition exists of any damage having been sustained in the "olden times."

In passing, we may observe, that the causes of earthquakes have not as yet been satisfactorily explained, but they are generally supposed to be connected with volcanic agency. It is conceded that they are produced by gases confined in the molten interior of the earth. Such gases, prevented by local circumstances from escaping, may, it is thought, thus shake the solid ground over a large tract, and even cause it to rise to a certain extent above its former level.

Such convulsions of nature have occurred in this country, but not to the extent, or accompanied by the danger, usually supposed.

Earthquakes are of two kinds — vertical and oscillating — the late one being of the latter description.

The first serious earthquake, of which there is any remembrance, occurred on the 8th of December, 1812, about seven o'clock in the morning. The motion was vertical, and was felt over the whole of Southern California. Its effects were disastrous, probably more so from defective architecture than from the force of the shock. By it, the roof (which was a stone arch) of the church of San Juan Capistrano, in this county, was thrown down; the congregation were at service at the time, and thirty-six

persons were killed in the ruins. A circumstance, which at the time was considered very singular, but which can easily be accounted for, is narrated of this catastrophe — that a woman and child who were buried in the ruins, were dug out the next day, alive and well. This church had been but lately built, having been finished on the 8th of September, 1806 — thus is was occupied only six years and three months.

At the same time, the tower of San Buenaventura church was so much injured by the shock, that it had to be taken down — from perpendicular, it changed to a leaning position, and the safety of the people required its removal.

1812 seemed to be a year of earthquakes. From December to the following March, there were frequent shocks — as many, it is said, as 300 distinct and well-defined quakes.

On the 21st December, 1812, another severe earthquake occurred. By this one, the church of Santa Purissima, in Santa Barbara county, was destroyed. The new church (the present one) was built six miles from the site of the old Mission buildings. The church of San Luis Obispo was very much damaged, but not entirely destroyed.

Of this latter earthquake, a circumstance is related similar to what has just now occurred in several places. On the rancho Las Posas, there had been a very small stream, but by this great convulsion of nature, it became a large stream, and remains so to the present day.

Another occurrence is worth stating. An American ship, engaged in smuggling, was laying anchored off a cañon at the Rancho Refugio, in Santa Barbara county. The sea became violently agitated by the earthquake, and the captain let go his cable; the vessel was drifted ashore and up the cañon, the receding waters bringing her back to her proper element. The captain's name was Geo. Washington. He afterwards settled in Guadalajara, in Mexico.[1]

These are the two great earthquakes known to the oldest inhabitants. That of the 8th of December was equally destructive here as in what was then called the upper country; that of the 21st was more destructive above.

Since that time, there have been only slight shocks of earthquake, till that of July, 1855. It was vertical, and shook the houses considerably, doing no further damage than cracking the walls of the buildings.

The late shock was of longer duration than any preceding one; its effect was more gentle here; elsewhere, it has been the most violent of any, as may be conceived by its effects on the substantial buildings at Fort Tejon, and by the terrible disruption of the earth.

We may here relate what has come to our knowledge through the Rev. Mr. Bateman, who was traveling to Fort Tejon at the time. Previous to feeling the earth's vibration, his attention, and that of his party, was attracted by a tremendous noise issuing from a mountain in that neighborhood, south of the Fort. Immediately after, they felt the

shock. In conversation with Mr. Botts, in charge of the mill at the Fort, he stated that his attention was also attracted by the same noise, and on looking towards the mountain, he saw issue from its topmost peak, a mass of rock and earth, which was forced high into the air — this was unaccompanied by smoke or fire. The shock immediately succeeded. Thereafter, a noise from that mountain, was premonitory of every succeeding shock, no matter how slight. This was certainly produced by an explosion of the gas above referred to, and which has been discovered in action elsewhere in that region.

The earth's disturbance, as far as heard from, seems to have been most severe in the vicinity of Fort Tejon. There the ground was seen to open a width of at least twenty feet, and close with great violence, leaving a ridge which can be traced for forty miles, passing through mountains in its course.

Great anxiety is felt by our citizens for the safety of San Francisco. Judging from the line of disturbance, and we have it recorded from the Mohave to the Tule rivers, running north-west and south-east, if the line be continued, or not materially diverged from, the concussion would reach and probably exhaust itself in the ocean, and not extend to that city. If it be felt there, we think it will not be as severe even as we have had it. At all events, we most sincerely hope so.

An effect of this earthquake may be noticed — that it very generally produced a sensation in the human system similar to sea-sickness, some persons vomiting severely.

Notes

1. J. W. Joy (personal communication, 1978) has found that the ship captain (George Washington Ayres) who figures in this and other accounts commanded the *Mercury*, which was in Sitka in December 1812. This account has therefore been somewhat garbled, and should not be taken to be a reliable record of the occurrence of a tsunami in 1812.

13. Los Angeles *Star* January 17, 1857 p. 2, col. 2

At five o'clock yesterday afternoon a very severe vertical earthquake was experienced here. The earth moved from south to north. It was almost as strong as that a week ago.

14. Los Angeles *Star* January 17, 1857 p. 2, col. 3-5

In our last, we noticed the occurrence of a severe shock of earthquake in this

locality, but without particularizing any of the incidents. At the time of publication, we had no information concerning the effects of the earth's disturbance elsewhere. Since then, we have received a mass of information on the subject — thanks to our friends in the various localities — which we lay before our readers to-day. The subject is one of peculiar interest; and although nothing can be known positively as to the cause of this terrible phenomenon — notwithstanding many plausible theories are advanced on the subject — yet all take a deep interest in the effect produced in different localities, and are anxious to become acquainted with the facts. We devote a large space to the matter to-day, not alone from its vast importance, but as it has formed almost the exclusive topic of conversation, and also as it is a matter for historical record.

On Friday morning, the 9th of January, at twenty-five minutes past eight o'clock A.M., the morning being calm, cool, and clear, the sun shining brightly, a shock of an earthquake was felt here. The earth's motion was very gentle at first, those sitting at table supposing some one was shaking it; it gradually increased in violence till every house, with all its contents were seen to rock from side to side, as if about to topple over. There were three distinct shocks, the pause between them being perceptible only to those who have long lived in countries where earthquakes are more common than here. The duration of the oscillation was fully two minutes. The vibration was North and South.

In half an hour after, another shock occurred, much less violent; another within an hour from that; and during the day a number of slight vibrations. At five o'clock in the afternoon, a shock occurred almost as severe as the first, which was followed at intervals by slight motions, till about eleven o'clock, when another heavy one occurred. During the night several other vibrations were felt.

On Saturday several slight shocks occurred — with a severe one about eleven o'clock at night.

Sunday was quiet, till about eleven o'clock at night when a pretty strong vibration was felt, and thereafter at intervals throughout the night.

Monday was generally considered free from shocks, although many say they felt them distinctly throughout that day also. Since then the earth has remained quiet.

INCIDENTS

It was not, for the moment, thought of, what produced the rocking of the tables, chairs, beds, and furniture generally; but there was little time given for reflection. In another instant, the fearful cry of "earthquake" issued from every mouth — then a rush, shouting and screaming, such as may well be conceived, but cannot be described. At the hotels, the breakfast tables were instantly deserted; people wildly rushed

to the streets, tripping and tumbling over each other in their hurry and dismay — in some cases, blocking up the door, so as to prevent egress for the moment. Many, used to indulge in a comfortable snooze of a morning, were unceremoniously turned out of their comfortable quarters, in anticipation of having the roof about their ears before they could make their exit. These took no thought of their toilet — but gallantly gave their linen to the breeze, in hopes of bringing up in safe quarters. One gentleman, who, in his hurry, mistook his window for a door, was seen running along the roof of an adobe building, thinking, should it fall, it was better to be on top of it, than it on top of him. Another, enjoying the luxury of a bath, stood the rocking for some time, but at last was compelled to evacuate the premises, and rush to the yard, where to his horror a number of ladies had also sought refuge and were seeking consolation in prayer. Whether from the shock to his feelings, or the shock of the earthquake, he was immediately brought prone to the earth, when he managed to creep under cover, unobserved.

The most ludicrous scenes occurred on every hand — in some cases men falling down in the streets on their knees, without well knowing why, perhaps because persons of a devotional nature suddenly took to prayer in the streets, moved thereto by their fears rather than their habits.

The effects on the lower animals was very apparent. Horses, mules and cattle took to flight, or if tied up trembled and fell down with fright. Domestic fowls, and the birds, flew wildly about, uttering the most piteous cries.

The river was thrown out of its bed over the banks, and receded; pools of standing water were driven about; so was the water in the zanja. In several stores, goods were precipitated to the floor; in one house, about $30 worth of bottles were broken. In the mill at the upper end of the town, a pile of flour sacks were overthrown and blocked up the doorway — the mill sustained no damage.

On the whole, no damage of any consequence, has been sustained by our citizens — although elsewhere considerable property has been destroyed, and we regret to say, severe personal injuries inflicted, and one life even sacrificed by the awful visitation.

On a ranch belonging to Mr. Temple, on the San Gabriel River, the earth for a considerable distance was rent asunder, leaving a ditch some three feet wide. The disruption was traced for miles along the river, which was turned out of its bed for many rods in length.[1]

The upper school house is cracked in one place; private houses are also cracked, some of them very considerably.

On Friday night, a number of people who had been started out of their bed by the

heavy shock about eleven o'clock, made a fire in the street, intending to remain up all night, rather than run the risk of being killed by the falling of the houses.

The disruption passed near to a house on Reed's Ranch, in which were several persons, all of whom effected their escape, except a woman, who was killed by the falling of the house.[2] The wall struck her head which was smashed, no other part of the body being injured or even marked. Her remains were brought to this city and interred.

We have heard a rumor that a man who was riding along the line of disruption having dismounted from his horse, was partly engulphed, but managed to extricate himself from the loose earth with which he was covered up.

We have it, on reliable authority, that an old man, name unknown, but who was familiar to all our citizens, was walking on the Plaza at the time towards the church, when he fell down and was taken up a corpse. He was very old, supposed to be between 80 and 90.

It is reported that the church at San Buenaventura has been nearly destroyed by the shock of the earthquake. The rumor is vague, and not relied on by many.

We shall now proceed to give the communications of our friends, whereby will be seen the effects of the earthquake in various localities, embracing a very large section of the southern country: —

OPENING A RIVER

On a range of hills, about fifteen miles from the coast, in the district of San Fernando, we understand that a surveying party have discovered quite a large stream making out of the mountain and down a cañon, where, to their knowledge and complete satisfaction, not to say to their sorrow, no water was running or could be found previous to the earthquake.[3] By the letter from Tejon, it will be seen that a similar circumstance occurred in that vicinity.

VOLCANIC ACTION

We were lately informed by Mr. Stanley, of Capt. Greenwell's coast surveying party, that on the side of a high mountain, in the vicinity of San Fernando, he discovered a fissure in the rocks, from which a hot gas was fiercely issuing. The rocks and ground were almost too hot to be touched.[4] Farther down the mountain, was a precipice, where he was informed by the natives, light was frequently seen at night, but no one ever attempted to discover the cause. It was no doubt caused by the ignition of the gas, produced by a favorable action of the surrounding atmosphere.

EFFECTS AT CAHUENGA

A person who was at this place[5] at the time of the shock, describes it as being very violent; trees were knocked about as if mere willows, the earth turned every way; he was knocked down, and for a time could not get up again. Altogether the

report makes it much more violent than it was here.

EFFECTS AT SAN FERNANDO

The shock here was also very violent. It knocked down two houses, but did not effect the mission buildings.

EFFECTS AT THE MISSION, MONTE, &C

In this district, the shock is represented as having been much more severe than in the city. In the Mission[6] several houses are badly damaged, and the church is represented as having been very much cracked.

At the Monte,[7] we have been informed that men were dashed to the ground; that horses were overthrown; and that several houses were greatly cracked. No personal injury sustained.

The dwelling house at Carpenter's Ranch,[8] we understand, is very much cracked.

FROM FORT TEJON

Fort Tejon, Cal., Jan. 11th, 1857

Editor of Los Angeles Star:

SIR — Presuming that your readers would be pleased to obtain some information respecting the effects of the terrific earthquake experienced at this post, I will endeavor to give you a slight description of the same. The first shock took place about thirty minutes past six o'clock, A.M., on Friday, January 9th, which was succeeded, at twenty-seven minutes previous to nine o'clock A.M., by the most terrific shock imaginable, tearing the Officer's quarters to pieces, severely damaging the Hospital, and laying flat with the ground the gable ends of nearly all the buildings erected, including the Quartermaster's storehouse. Immense trees have been snapped off close to the ground, and every building between Fort Tejon and Lake Elizabeth leveled with the ground. Many persons have been seriously injured, and one woman killed at "Reed's Rancho." The officers and troops at this post have thus far escaped any injury.

The shocks and vibrations have continued at regular intervals up to the present time, say five o'clock P.M. It is very evident that a powerful volcanic eruption is in progress a few miles to the southward of the garrison. You can well imagine the alarm constantly existing in the minds of every person, caused by the frequency of these frightful shocks.

The earth has opened in many places for a distance of twenty miles. Many instances occurred of narrow escapes from injuries by the falling buildings. — Amongst them, the lady of Capt. R. W. Kirkham, Assistant Quartermaster, who is absent from the Post on official duty; also, Lieut.-Col. B. L. Beall, commanding the Post, who had barely sufficient time to escape from his bed amidst the falling of plaster, the crashing of

material, falling of chimneys, &c. It is a miracle that no lives were lost, for which mercy we are indebted to the protecting influences of an All wise Providence.

We feel quite anxious to learn the effects at Los Angeles, as the line of disruption seems and does extend from south-east to north-west.

Mr. David Alexander has come into garrison from the vicinity of Santa Amelia,[9] and reports that the beds of many small streams have been enlarged, and now form almost rivers; and that immense numbers of fish have been thrown out of the Lakes[10] upon dry land.

The effect of this convulsion of nature will be felt far and near. I have just learned that some of the buildings at the Reservation[11] have been much injured.

Yours, truly,

ALONZO C. WAKEMAN

Quartermaster's Deputy, U.S.A.

P.S — The driver of the wagon which conveyed Lieut. Col. Ripley to Fort Miller, has just arrived, and reports that the shock of the earthquake was experienced at Tule River, 100 miles distant, at about the same time on Friday morning, but that no serious damage was sustained.

A.C.W.

FROM SAN BERNARDINO

San Bernardino, Jan. 8th, 1857

SIR — We experienced a very heavy shock of an earthquake this morning about eight minutes past 8 o'clock, which lasted nearly three minutes. While I was washing, Mr. Glaser was emptying a ten gallon keg of wine into another by my side, when he said "an earthquake!" Shovels in the store fell on the floor, and the tin ware hanging on the joists swung every way. We then ran out of the store to the street, and felt the earth move as sensibly as if we were walking on shipboard. Every person believes that it lasted at least over five minutes. As the teamster is about to leave, I am unable to give you any more particulars than what we have seen and felt ourselves. The people are all out on the streets conversing and relating what they were doing when they first felt the shock. I have just seen a bucket of water drawn from a well since the quake, and it is white as milk. A bucket full of water was drawn an hour previous, and it was clear as crystal. People observed the standing waters on the streets emptied out of their places. Peach and shade trees were seen shaking for five minutes afterwards. The store of Harris & Meyer was cracked; also, the store of Chas. Glaser, and the school house. Goods were thrown from the shelves in several stores. The shock ranged from East, and lasted over two minutes; then changed to South.

The people from outside the city are coming in and relating the circumstance,

but I have no time to give you any more items.

Everybody is drunk from the effect of the quake.

Yours respectfully,

L. GLASER

From other sources, we have a confirmation of the above facts, with this addition, that immediately after the shock, a terrible report was heard along the mountains on the north, towards the Cajon Pass, which lasted a considerable time.

Reports of the shock having been felt a considerable distance from town, but no damage reported.

On Saturday, a plummet was suspended which vibrated nearly all day, sometimes as much as four inches past the centre.

On Sunday another shock was experienced; next morning another, but quite gentle. The people, however, were in a state of continual alarm.

FROM THE MOHAVE

We have received the following intelligence regarding the earthquake from Wm. Denton, Esq., engaged in surveying in the Mohave country, who has just arrived from his camp on the Desert.

The camp is situated at Kingston Springs, 200 miles north-east from San Bernardino. On Friday morning, between 8 and 9 o'clock, Mr. Denton was at the upper crossing of the Mohave River, about fifty miles from San Bernardino.[12] His attention was attracted by hearing a peculiar harsh, grating noise, immediately after which he perceived the motion of the earth, which became very violent, and lasted thirty or forty seconds. With great difficulty he could keep his feet. The earth seemed to have two motions, vertical and oscillatory. After the shock, towards north and north-west, heard a tremendous noise, as if thunder, accompanied by the grinding of rocks and the crashing of mountains. There was then a short pause, when the appalling noise was again heard. During the earthquake, Mr. Denton was at the hot springs.[13] In such localities, the ground when trodden or stamped on, generally gives forth a hollow sound, which may account for the extreme violence of the oscillation at that point.

At night he camped in the Cajon Pass, when he experienced two more shocks, about nine and eleven o'clock, which were not very severe. He does not know whether these were accompanied by noise, as the wind was high at the time. Next day he arrived at San Bernardino, when he experienced the shocks mentioned by our correspondents.

The weather at his camp at Kingston Springs was intensely cold — rain, sleet and snow, with hard frost every night.

Mr. Denton states, that the violence of the shock he experienced, had it reached this city, would have leveled every building in town.

Notes

1. Temple's Ranch was the Rancho El Cerrito, which covered an area that is now to the north of Long Beach. The ranch headquarters were on a hill overlooking the Los Angeles River, in what is now north Long Beach (Hoover *et al.*, 1966, pp. 152-153). The cracks presumably occurred in the floodplain of the river. The account says the San Gabriel River because at this time, as shown on the map of Williamson (1856), the San Gabriel River ran down what is now Rio Hondo and joined the Los Angeles River about 18 kilometers above its mouth, the combined streams being called the San Gabriel River. The present San Gabriel River channel was established during floods in the 1860's (Troxell *et al.*, 1942).

2. According to Conkling and Conkling (1947), Reed's was on the south side of the old road (later U. S. 99) in Gorman. It must therefore have been nearly on the line of rupture.

3. This was probably Limekiln Canyon, in the San Fernando valley south of Oat Mountain. See (18) for a fuller description and discussion of this identification.

4. This was almost certainly a burning petroleum seep; see (18).

5. Cahuenga was at the northern end of Cahuenga Pass, in the San Fernando valley, near Universal City (Hoover *et al.*, 1966, p. 164).

6. Presumably Mission San Gabriel, in the city of San Gabriel.

7. King (1971) states that the "Monte" was on the banks of the San Gabriel River above Whittier Narrows, a little to the south of the present El Monte.

8. Hoover *et al.* (1966, p. 153) identify Carpenter's Ranch as Rancho Los Nietos, in the vicinity of Downey.

9. Santa Amelia presumably refers to the Rancho San Emigdio, which is on the slope to the north of Mount Pinos at the extreme southern end of the San Joaquin Valley. Brewer (1966, p. 385) found a Mr. Alexander holding this rancho in 1862. Contemporary spelling of this name varied considerably; for example, Antisell (1856, p. 206) gives it as San Emilio.

10. Probably Buena Vista and perhaps Kern Lake; Tulare Lake is too far north to have been observed.

11. The Tejon Indian Reservation; see (24) and (25).

12. The location of Mr. Denton given in Table 2 is based on the map and reported latitudes in Whipple (1856).

13. Whipple (1856) describes only cold springs at this crossing and Waring (1965) does not locate any hot springs near this point.

15. Extracts from a letter of H. R. Myles to Benjamin D. Wilson, January 28, 1857. (Box 6, Benjamin Davis Wilson Papers, Huntington Library, San Marino)[1]

We will finish racking[2] off the wine about the same time, the wine is not very clear that is the most of it owing to two causes. One is many of the casks were closed too tight before the wine was done fermenting, and the other is we have had about fifty earth-quakes in the last two weeks, three of which rocked the house very much, and cracked the plastering and walls in many places but has done no serious damage... I will take out some brick and a Brick Mason to day to take down and rebuild the South[2] chimney.[3]

Notes

1. This letter was sent from Lake Vineyard, Wilson's ranch. McFarland (1949, p. 289) says that this covered much of what is now Pasadena and San Marino, Wilson's house being in what is now the northwest part of San Marino.
2. This word is partly illegible and our reading is conjectural.
3. Much of this letter deals with construction, and it is not certain that this sentence should be read as implying serious earthquake damage to a chimney.

16. Reminiscences of H. D. Barrows, August 5, 1906. (In Lawson *et al.*, 1908, p. 450)[1]

The great earthquake of January 9, 1857, in southern California, opened the ground for nearly 40 miles in a straight line near Elizabeth Lake. I had a brief account of it in the *San Francisco Bulletin* about February 1, 1857 – my letter (signed "Observador") being dated January 28, 1857.[2]

Only one life was lost by that great convulsion of nature, a woman being killed at Fort Tejon by the falling of adobe walls; and, considering the colossal disturbance, very little damage was done to buildings here in Los Angeles. This is probably accounted for by the fact that our buildings were of only one story, with walls 2.5 and 3 feet thick. At the time of the great upheaval, I was in the yard at the south side of the adobe house of William Wolfskill, the pioneer, near the present site of the Arcade Depot in Los Angeles. I first stumbled toward the west, and was almost thrown down; then, after a brief period, I commenced to stumble in the opposite direction. Other persons near me stumbled in similar fashion. The long wide corridor on the south side of the Wolfskill house was hung with grapes, and I noticed that they swung back and forth clear up to the rafters. Water in tanks was thrown out in

numerous instances, clocks were stopt, etc. The movement seemed to be comparatively slow, giving things time to recover after moving in one direction.[3] If the motion had been short and sudden, the damage would have been appalling.

Notes

1. Barrows' diary (in the possession of Mrs. Thomas P. Cullen, Monterey Park) contains no information not in (16) and (41).
2. This letter was published February 3; it is reprinted here as (43).
3. Compare Barrows' comments at the time (41).

17. Reminiscences of Harris Newmark, ca. 1915 (From Newmark, 1926, p. 204)

In the beginning of 1857, we had a more serious earthquake than any in recent years.[1] At half-past eight o'clock on the morning of January 9th, a tremor shook the earth from North to South; the first shocks being light, the quake grew in power until houses were deserted, men, women and children sought refuge in the streets, and horses and cattle broke loose in wild alarm. For perhaps two, or two and a half minutes, the *temblor* continued and much damage was done. Los Angeles felt the disturbance far less than many other places, although five to six shocks were noted and twenty times during the week people were frightened from their homes; at Temple's *rancho* and at Fort Tejón, great rents were opened in the earth and then closed again, piling up a heap or dune of finely-powdered stone and dirt. Large trees were uprooted and hurled down the hillsides; and tumbling after them went the cattle. Many officers, including Colonel B. L. Beall — well known in Los Angeles social circles — barely escaped from the barracks with their lives; and until the cracked adobes could be repaired, officers and soldiers lived in tents.

Notes

1. As Wood (1955) pointed out, this very likely refers to the date of composition, sometime before 1915.

18. Letter of W. E. Greenwell to A. D. Bache, February 24, 1857 (pp. 130-133, Vol. 23, 1857 Correspondence of the Superintendent, Records of the Coast and Geodetic Survey, Record Group 23, U. S. National Archives microfilm MC 642, Roll 176, frames 280-282)

Coast Survey Camp
Conejo Station
February 24th 1857

Dear Sir

Since my last letter I have finished my station San Fernando & in about 3 weeks will have completed my observations at this, when I propose to break up my camp & resume the work on Santa Cruz Island. The winter has not been favorable for my work. Fog & hazy weather kept me at San Fernando much longer than I had reasonably expected & here it has been no better. There seems to be no precedent in California upon which to rely. One winter brings forth one thing, the following altogether different so that it is unfair to base a seasons work upon that which precedes it.

I have been in the field since December. In this time I have gotten through with but two Main Stations with lines averaging from 25 to 35 miles in length & to accomplish this much have been obliged to use heliotropes at two of the stations. My work comes out well however & in this much I am satisfied.

Whilst occupying the San Fernando station this lower Coast was visited by a most fearful earthquake whose centre seemed not far from us. We were encamped in a cañon at the foot of the mountain, my station in full view some 2212 feet above us.[1] I was seated in my tent about 8 o'clk in the morning the wind blowing a gale from the N.W. when we felt the first shock. We started to our feet & ran out. The Earth was in fearful agitation with undulations so quick & rapid as almost to throw me from my feet. The sensation was very much as that felt on the deck of a small vessel in a heavy "chopped sea".

I was interested to know whether my stations remained unchanged but in subsequent measurements I could detect no difference in the angles.

Some three weeks previous to this earthquake I had erected a signal on the Santa Clara 32 miles from my station San Fernando. This signal I could never see whilst others equally distant were plainly visible. This one line kept me at this station three weeks after my other angles were all observed. Twice I sent to have it re-erected supposing it to have been pulled down, the second time in exploring the mountain we found a vent directly in the line "San Fernando — Santa Clara" from

which sulpherous steam was issuing.[2] To this cause I attribute my ill success in seeing the signal.

Subsequently I moved this signal some 8° out of the line but eventually found it necessary to send a heliotrope in order to observe the angle.

Just back of my camp was the dry bed of a stream, where in heavy rains water had at one time run; in this bed two weeks before I had sunk a well some 20 feet hoping to find water, but at that depth the earth was so dry I gave it up as fruitless. Two days after the first or heavy shock a little stream of muddy water was running by my camp which continued to increase each day, until when we moved was quite a little rivulet: no doubt the result of some new fissure in the mountain.

I send you an extract from my Journal giving the time of the different shocks as felt at our camp. It may interest you in as much as the tidal wave[3] may have been in some measure affected by them.

January 9th

"At 8^h 25^m A.M. had a severe shock of an earthquake which lasted about one minute. Wind N.W. strong.

At 8^h 31^m another slight shock.

At 9^h a very slight shock – At 9^h 31^m another shock similar to the 2nd.

At 4^h 47^m P.M. another slight shock.

Had the above several shocks to day. The wave seemed to travel from East to West"

Very respectfully

W. E. Greenwell

Prof. A. D. Bache

Sup^t U. S. Coast Survey

Washington D. C.

Notes

1. The position given for this triangulation station by Mitchell (1927), who calls it "San Fernando (Old)", places it on a subsidiary peak of Oat Mountain, specifically the one that is at the head of the stream that is the first westerly branch of Limekiln Canyon, counting upstream from Horse Flats. The stated elevation difference puts the camp on the valley floor, probably in Limekiln Canyon or perhaps Wilbur Wash.
2. This almost certainly refers to a burning petroleum seep; the descriptions given here and in (14) tally very well with that of another occurrence provided by Arnold and Johnson (1908). Such seeps are not uncommon in southern California; Whitehead (1976) gives the history of several in the Santa Barbara region.

3. This does not refer to a tsunami, but to the regular ocean tides, which at this time were thought of as a propagating wave.

19. Letter of W. M. Johnson to A. D. Bache, January 19, 1857 (pp. 139-145, Vol. 23, 1857 Correspondence of the Superintendent, Records of the Coast and Geodetic Survey, Record Group 23, U. S. National Archives microfilm MC 642, Roll 176, frames 294-297)

Camp Sycamore Valley Cal[1]
Jan 19th 1857

Prof. A D Bache
Washington City
My dear sir

On the morning of the 9th inst we experienced the most violent shocks of an earthquake ever remembered to have been felt in this state and should it extend to San Francisco without diminution of its force as felt here, we may expect to hear a melancholy account of the loss of life and property.

The motion to me was vibratory only, though others contend that it was also undulatory, in a direction from SE to NW and was first felt at 24m past 8 A.M. on the 9th inst and lasted about 2 minutes. During that time we with difficulty[2] kept on our feet. Many things in camp were thrown violently to the ground. The tents shook as by a gale. My sensations at the time were those of exhilaration and yet the cause producing them made us also feel sensible of a nausea similar to that occasioned by being at sea: several persons have since told me they were so powerfully affected as to vomit.

At 34m after 8 A.M. a second shock, lasted but a few seconds and not so violent as the first: at 36m after 8 A.M. a third shock quite violent lasted about 10 seconds at 38m past 8 A.M. a fourth shock accompanied by a loud rumbling noise like distant thunder. This was the only sound occasioned by this phenomenon during the whole time. At 12m of 9 A.M. a fifth shock slight and momentary.

On the evening previous I received a note from Mr. C. M. Bache whom I had sent to San Francisco two weeks before to purchase stores and make arrangements for getting a vessel to move us, informing me that he could get no conveyance to camp and desired to be sent for at Santa Barbara: wishing to see the effects if any produced by this earthquake I availed myself of the occasion & accordingly left camp shortly after the last shock for San Buenaventura 30 miles distant: in going there we ford the Santa Clara River six miles from its mouth. The stream in itself is insignificant

its bed however is from a half to three quarters of a mile wide from bank to bank and it was here I met with the first evidence of the terrible power exerted by the awe-inspiring convulsion of nature as recently felt: long cracks were visible in the bed of the river many of them being six or eight inches across and extending in a direction SE and NW. These openings must at one time have been considerably wider for many of them had evidently been filled with water from the River and when the earth closed was thrown up with sand to the surface for on either side of the crack lay a mound of wet sand: these appearances were visible as far as I could see up and down the bed of the River. In crossing I tried to avoid those places as much as possible but finally a wheel got into one and down went the wagon to the axletree. This crack I was satisfied was at least two feet deep but did not stop to investigate it further nor was I ambitious to sound another in the same way.

Near the mouth of the River the cracks are much longer & wider. Several persons residing on its banks within a mile of the mouth tell me they saw the water thrown up as high as six feet and that large blocks of earth sunk several feet below their former level & there remained. Others say they distinctly saw Anacapa and Santa Cruz Islands sink. In this last assertion I place no confidence for on that evening I saw through the "Arch Rock" at the east end of Anacapa as distinctly as I ever did.

On arriving at San Buenaventura in the evening. The Spanish population is about 250. I found the inhabitants in the greatest consternation: at the first alarm they without an exception deserted their tile roofed houses for the streets and the open country and there began to offer up prayers and lamentations for safety: in the mean time the roof of the old mission church, founded 1782, fell in with a tremendous crash and the square bell tower supporting at present four large bells, it formerly boasted eight, hung in the arches of the wall, one on each side, was so much shattered that the key stones of the different arches settled 2½ inches below their former beds. Several of the mission buildings, vacant at the time, were entirely destroyed and other houses in the place were more or less injured but no lives lost.

The old mission church is a large structure built of sundried brick it is 100 feet long by 30 feet wide on the inside. Its walls are about 45 feet high and six feet thick at the top: curiosity prompted me to visit the bell tower and roof. Till then I had no conception of the immense weight supported by the walls or how the weight was distributed as the interior room of the church is unbroken by a single column.

At 40 feet above the floor of the church firmly imbeded in the walls are large girders 18 inches apart. The walls being built up about 4 feet above them they have

no connection with the rafters & do not act as tie-beams. On those girders is a flooring of two inch planks, then a course of mortar in which are set burnt brick. The framing of the roof is of the most miserable description being tied together with raw hide without any other kind of fastening. The roofing consists of small willow poles placed near together and bound to the rafters by thongs of raw hide. On these poles is a layer of mud from 8 to 12 inches thick and in this the tiles are imbeded: the whole being supported by centre posts and purline posts resting on the flooring of the girders. The weight of the tiles alone has been computed at 35 tons, and the whole weight on the walls at about 250 tons.

At San Buenaventura (Jan 9th). This evening the shocks were continued. The first was at 27m past 8 P.M. slight and momentary, at 15m of 9 P.M. a second, quite violent but momentary: at 36m past 10 P.M. a third strong but momentary. To night the people deserted their houses and went into the street, the open country and on the hill-tops back of the mission buildings where they lit camp-fires and passed the night.

At Santa Barbara but little damage was done only two or three houses having been injured.

During my absence from camp every shock felt was noted in the Journal. The times of their occurrence may I think be considered as correct but their duration appears to have been judged of more by the recorder's feelings than his watch. The following is transcribed from the Journal

9th "At 30m past 8 P.M. felt a shock which lasted about 1½ minutes not so severe as the first one of this morning"

"At 40m past 8 P.M. felt a second shock which lasted about 1 minute. Slight"

"At 10 P.M. a third shock lasted about half a minute. Slight"

Jan 9th "At 40m past 10 P.M. felt the most severe shock of any though much shorter than the first of this morning"

Jan 10th "At 20m after 8 A.M. a slight shock"

Jan 11th "At 40m past 9 P.M. slight shock"

" " "At 5m past 10 P.M. quite severe lasted about 1½ minutes"

Jan 15th "At 40m past 10 P.M. a slight shock"

" 16th "At 48m past 12 A.M. a severe shock, lasted 1½ minutes"

" " "At 50m past 12 A.M. another more severe than the last, preceded by a rumbling noise"

" " "At 46m past 4 A.M. a slight shock"

" 17th "At 27m after 7 P.M. slight shock"

" 28th "At about 2 o'clock this morning felt a very severe shock"

The two last I recorded myself.

Since writing the above I have learned from good authority that at the Tejon and in the Tulare country the earthquake was very severe. A crack was there made several miles in length and six to eight feet wide. Many persons were killed[3] and most of those who escaped are moving away from what they consider a dangerously volcanic country.

I feel that this long letter from me will hardly repay you the time lost in looking over it but knowing that you take a great interest in this as in other natural phenomena I believe I can't give you a better idea of it than by simply stating what we felt and saw.

Very truly, your ob't svt
W M Johnson

Notes

1. Sycamore Valley was probably what is now Big Sycamore Canyon, just east of Point Mugu.
2. The words "we with difficulty" are repeated twice in the original.
3. This is the only mention of there having been more than one or two casualties; on the basis of our other sources we suspect this to have been based on false rumors.

20. Santa Barbara *Gazette* January 15, 1857 p. 2

On Friday last, January 9th, this city and adjacent settlements was visited by a succession of earthquake shocks, one of which was the most severe which has been experienced on this coast for a long series of years. So far as our present information extends, it was felt as far south as Los Angeles. It extended to Point Conception westward. No information has yet been received from towns situate north of this place, but we shall doubtless hear of its effects in many localities as yet unheard from.

In this city, the morning of the eventful day was ushered in by the same genial sun; the air was tranquil, and no unusual atmospheric phenomena indicated that any sudden danger was so near at hand. At about 10 minutes past 8 o'clock there was a sudden vibration of the earth, which was of brief continuance. By many it was unnoticed, but was distinctly observed by those persons who have felt this peculiar sensation at

former periods. At about half past 8, or at 22 minutes past 8 o'clock, according to those who assert that they had the "correct time," the severest shock commenced, and which continued from 40 to 60 seconds. It was universally noticed throughout the city, and was so violent in its vibrations that all the inhabitants fled from their dwellings, the majority of whom, on bended knees, and hearts throbbing with terror, made fervent supplications that the imminent and impending danger might be providentially averted.

This "shock" (for we have no more expressive phrase in the English language to denote the peculiar phenomenon, — the Spanish appellant "temblor" is more significant) commenced with a gentle vibration of the earth, which gradually increased, accompanied with an undulating motion, until it attained its culminating intensity, and then as gradually decreased, until it ceased its action altogether. The vibrations were in an easterly and westerly direction. The peculiar motion experienced during its continuance very much resembled that on board a vessel in a moderate sea. Happily, it passed away without causing material damage to this city. Many walls of buildings were cracked, and we candidly acknowledge that most of us were very severely frightened. We have heard of no unusual action of the sea during the above mentioned period. The slight damage which ensued therefrom to our dwellings can doubtless be attributed to the great thickness of their "adobe" walls, and the fact of their being built, with a few exceptions, of but one story in height.

Some three or four hours after the occurrence we took a short walk up to the old mission church. Near that building is a water reservoir, built of stone laid in cement. The earthquake, we noticed, had caused the water therein to be forcibly ejected over each of the four sides, which had found its way to the ravine near by in a large stream, — indicating the strong, vibratory, upheaval motion at that place.[1]

During the evening of the above day some two or three brief "shocks" or vibrations were felt; indeed, throughout the entire day and evening the earth, to us, seemed to be more or less agitated with a tremulous motion, but up to the present period we are happy to chronicle the fact that our beautiful valley continues "in statu quo."

The steamer Senator arrived the next morning, (January 10th,) bringing us the news from Los Angeles that the earthquake was severely felt at that city at about the same time of its occurrence in this locality. It was thought, on comparing notes, that its effects were more severe in that place than here.

Through the politeness of Mr. W. M. Johnson, U. S. Coast Surveyor for this District, we are placed in possession of the following interesting account of the earthquake phenomenon which occurred at San Buenaventura and vicinity.[2] The mission

church at San Buenaventura is badly injured. The roof has fallen in, or rather is supported by the walls and ceiling of the edifice, and the belfry is badly damaged. The greatest vibration and agitation of the earth is supposed to have taken place in the vicinity of the Santa Clara river. Mr. Johnson's position was some thirty miles southeast of San Buenaventura, in a cañada called Sycamore Valley, (Cañada de los Alisas,) sixty miles by land from this city. He noted the following observations: The first shock occurred at 24 minutes past 8 o'clock in the morning; vibrations heavy and violent, and continued 2 minutes. Second shock occurred at 34 minutes past 8. The third at 36 minutes past 8; was quite violent, and continuted 10 seconds. The fourth shock took place at 38 minutes past 8; this was accompanied with a loud, rumbling noise, a distinguishing feature, which was observed in no other shocks, either before or afterwards. The fifth shock was noticed at 12 minutes of 9, which was slight, and the sixth at 2 minutes past 9, which was also slight. The vibrations were N.E. and S.W. In the evening of the same day three momentary shocks were distinctly felt, the last one being the most intense. They occurred at 27 minutes past 8, at 10 minutes of 9, and 36 minutes past 10, respectively. At Santa Clara river the following interesting effects of the "temblor" were observed: There were large cracks in the bed of the river, running parallel to each other, for some ten or fifteen yards in length, in a N.E. and S.W. direction. About one mile from the mouth of the same river large square blocks of earth had sunk below the surrounding surface, and there remained.

Mr. Bodie called upon us on Tuesday and informed us that the earthquake was distinctly felt at Point Conception and at Santa Cruz Island. At the Point it shook the lighthouse and damaged the reflector. At Santa Cruz a portion of the bluff at that place fell down.

P.S. — We have to record two more "temblores" in this place since writing the above. One light shock occurred about midnight, and another strong shock at about 6 o'clock this morning.

During the observations of Mr. Johnson, above noted, no deflection of the magnetic needle was apparent. We are informed that in the vicinity of the Hot Springs at the period of the severe shock on Friday morning, large rocks on the neighboring peaks were detached from their position and rolled down the mountain side into the cañon. We trust that we shall not be unwilling chroniclers of any further "quakes" in this quarter.

Notes

1. It would probably be useful to check any estimates of ground motion for this earthquake by using them to predict water motion in this reservoir using the method of McGarr (1965). The description of the mission water supply system in Engelhardt (1923, pp. 85-88) and in Geiger (1965) enable us to identify this reservoir as the lower of the two northeast of Mission Santa Barbara. It was built in 1806, and was 33.5 meters square and about 2 meters deep; it has since been relined and is now the #3 reservoir of the Santa Barbara city water system. The depth of water in the reservoir before the earthquake is not stated, but Trask (1864) mentions that in Santa Barbara the earthquake threw water "over the surface from a shoal well, seven feet deep, the water in which was less than three feet in depth." This depth is about the same as that shown in the 1847 sketch of Hutton (1956).

2. The material in this paragraph, being derived from Johnson, is not independent of his letter (19), though it is a little more full in some details.

21. Santa Barbara *Gazette* January 22, 1857 p. 2

On Friday, January 16th, there was another earthquake at or about 4 o'clock, P.M. Fortunately, it was of brief continuance. No damage ensued therefrom. It was sensibly felt throughout the city, and was of sufficient intensity to cause people to leave their houses. There was a slight shock on Sunday morning, the 18th inst., and another moderate shock on the night of the 20th instant.

From the surrounding country we have received the following information. The severe shock which occurred on the 9th inst., was felt to the north and west of this city as far as Point Arguello, also at Santa Catalina and Santa Rosa islands.

Mr. Warner arrived here on the 17th inst. from Fort Tejon, via Elizabeth Lake and San Buenaventura,[1] to whom we are indebted for the following interesting account of the effects of the recent earthquake as experienced at the above locality and vicinity. From his statement, the earthquake of the 9th instant, as there experienced, exceeded in intensity and severity that observed in any other locality, so far as heard from. The main disturbing force of the shocks which were so widely felt on the 9th, without doubt, was in the vicinity of the Fort, and extended to an unknown distance in the Desert. The earthquake occurred on Friday morning, the 9th instant, at about the same time that it was felt here. All the houses, with two exceptions, were thrown down or otherwise injured so as to be rendered entirely

useless. The shock was preceded with a peculiar rushing or rumbling noise, and for more than a week thereafter noises somewhat resembling distant thunder were heard. Fortunately, no serious damage to life or limb occurred. Mrs. Kirkham, wife of the Quartermaster, was slightly injured. Immediately after the shock had passed, an express messenger with advices was dispatched to General Wool. All of the public works at the Fort are necessarily suspended. The damages are estimated at $50,000.

Two companies of U. S. troops, who had just arrived from New Mexico, were having their horses herded in Kern river valley. When the shock occurred, the men in charge were around their camp fires in the morning. It very unceremoniously tipped over their coffee pots, their camp kettles, and themselves also. Upon looking at the river, they were astonished to see Kern river running *upstream*. Large trees were uprooted, and in the language of some who were *thar*, "all creation seemed to be going into one eternal smash." The water in Tulare Lake was upheaved to an unknown height, and large quantitites of fish were thrown upon its banks, where they have remained.

At the "Mill," some twelve miles west of Tejon,[2] the shock was very heavy. It tore up large trees and twisted off branches, threw people on the ground, and when over, caused a general stampede for the Fort, upon the supposition, we suppose, that that place was "safe as any," and that "misery loves company." One mile and a half this side of the Fort a lady was badly hurt. When the shock was first felt, she ran out of the house and crept under a cart for safety. A limb of a tree standing close by, fell down directly across the cart, which it crushed to pieces, injuring her severely. Mr. Gale, whose dwelling was situated about the same distance from the Fort, experienced a severe injury during his exertions to rescue his children from the ruins of his falling house. At Reed's Rancho, six miles from Tejon on the Los Angeles trail,[3] the wife of Mr. Reed's vaquero was killed. A beam fell in the house on her head, killing her instantly.

A large rent in the earth was traced by Mr. Warner a distance of eight leagues.[4] When on the high ground by Elizabeth Lake it could still be discerned running in an easterly direction towards the Colorado river. This rent was in some places five to 10 yards wide, the earth at times filling it up like ploughed furrows; at others the ground stood apart, leaving a deep fissure. Its course was in a straight direction, across valleys, through lakes and over hills, without regard to inequality or condition of surface. On either side, the ground had been more or less disturbed for a long distance.

While on the way hither, when traveling between Cumola and San Francisco Ranchos,[5] some thirty miles distant from San Buenaventura, a heavy shock was felt

in the afternoon at the same time that it was noticed here on Friday, January 16th, which we have already above described.

Notes

1. In reading this account it should be remembered that at this time the road between Fort Tejon and Los Angeles did not follow the present more direct route. As shown in Williamson (1856), the road ran along the line of the fault from Gorman to Quail Lake, and thence through the Antelope Valley, reentering the mountains at Oakgrove Canyon and following the fault to Elizabeth Lake. It then traversed San Francisquito Pass and went down San Francisquito Canyon to Castaic Junction. At this point the road to Santa Barbara branched off down the Santa Clara River to Ventura.
2. Cullimore (1941, p. 66) locates this at Mill Potero, about 22 kilometers (14 miles) west of the Fort, and probably less than a kilometer from the fault.
3. See (14), note 2.
4. About 40 kilometers; this is roughly the distance along the fault from Gorman to Elizabeth Lake. This is the distance the road followed the fault line.
5. Map 36 in Beck and Haase (1974) shows the latter rancho to be along the Santa Clara River at the present Los Angeles-Ventura county line.

22. Journal History of Las Vegas Mission, January 9, 1857 (From Seismological Notes, *Bull. Seism. Soc. Am.*, 49, 117-118)

Friday, Jan. 9. Quite a reeling of the earth took place at 9 o'clock A.M. It lasted 1½ minutes.

23. Letter of Lt. Col. B. L. Beall, January 9-10, 1857 (Letter #B4, Letters Received, 1857, Department of the Pacific, Records of U. S. Army Continental Commands, Record Group 393, U. S. National Archives, Washington, D. C.)

Fort Tehon, California
January 9ht 1857.
8 o clock P.M.

Brevet Major W W Mackall
Asst Adjt General
Department of the Pacific
Benicia Cal
Sir

I have the honor to report for the information of the Commanding General of this Department, that at about six o'clock this morning, the shocks of an earthquake commenced and have continued with more or less violence, at intervals of five or six minutes, up to this time. The greatest shocks took place at 27 minutes before 9 o.clock A.M. The destruction to property, both public and private, has been immense. Many of the buildings at this Post have been so injured as to be totally uninhabitable, as follows.

1st The unfinished building, intended for a Quartermaster's Storeroom and Office. One end of this has been thrown down, and the remaining walls badly cracked in several places. It can be repaired.

2nd The unfinished building intended for Captain's Quarters. This had one end thrown out of perpendicular and badly cracked. It can be repaired.

3rd An unfinished building, containing two sets of Quarters. This had one end thrown down, and the other end thrown out of perpendicular, so that it will have to be taken down. The walls sustaining the roof are secure, and the building can be repaired. The two ends of the kitchen attached to this building are thrown down, and the main walls are cracked and injured, but the kitchen can be repaired without distroying the roof.

4th The unfinished building, occupied by Major Blake and Lieutenants Ogle and Magruder. This has been cracked and injured in many places, but has suffered no material injury. I think it can be occupied with safety. Both ends of the kitchen attached to this building have been thrown down, and the remaining walls are badly cracked, but it can be repaired without removing the roof.

5th The Quarters occupied by Company "H" 1st Dragoons. This has been cracked and shaken in many places, but no so much as to injure the stability or security of the building

6th The Quarters occupied by Company "G" 1st Dragoons. One of its chimneys has been thrown down. Its walls are more or less cracked, but it is sufficiently secure to be occupied, and can be repaired with but little expense

7th The end wall of the unfinished company kitchen has been badly shaken and cracked. The building, otherwise has received no material injury

8th The building occupied by Brevet Major Grier This has been badly shaken. Its chimney tops have been thrown down, its walls cracked in many places, and its plastering thrown down and injured. I think the walls of the building secure, and that it can be occupied with safety.

9th The Quarters occupied by Lieutenant Colonel Beall. This has received more damage than any of the finished buildings of the Post. Its chimnies have been thrown down, its plastering broken off in many places, and one of its ends so badly shaken and cracked, as to be in my opinion too insecure to be occupied

10th The Quarters occupied by Captain Kirkham. This has been badly shaken and cracked, its plastering broken off in many places, and its chimnies thrown down. I think the walls secure and capable of sustaining the roofs.

11th The kitchen attached to Colonel Beall's house. This has been badly shaken and cracked. I consider it insecure

12th The building occupied as a commissary store house, and hospital. This has been badly shaken and cracked throughout, and its plastering very much injured. Its main wall has been but little disturbed from the perpendicular, and is, I think, secure, and capable of sustaining the roof.

13th The unfinished building intended for two sets of Quarters. Upon this, I can observe no material injury.

Most of the chimney tops have been cracked and there is danger of fire being communicated through these cracks to the roofs.

Fortunately no lives have been lost at the Post. The sick of the command are now in tents, although the weather is very cold. The shocks have been very extended, and less severe at the Post, than on the Los Angeles road, or in the Tulare

valley. Several of the houses in the vicinity have been completely demolished, but the injury to life, so far as heard from, has been slight. Large fissures have been opened in the Los Angeles road, and in some places on the road there have been immense land slides. It is said that ~~the water~~[1] in the Tulare lakes, the water was thrown twenty feet into the air, during the greater shock. The largest trees have, in many instances, been torn from their roots.

In order that the General Commanding, may [be] informed of the havoc done to the Post, at the earliest possible moment, I have thought it necessary to forward this by an express.

I have the honor to report for the information of the General, that I shall repair to the Head Quarters of the Department by the next steamer.[2]

January 10th 9 o.c. AM.

I have the honor to report that during the night, and up to this time, the shocks have continued with much violence, at intervals. The buildings have been much damaged since 8 o clock P.M. of yesterday.

I am very Respectfully
Your obdt servt
B. L. Beall
Lt Col. 1 Drags
Comg Post

Notes

1. These words are crossed out in the original.

2. Wood (1955, p. 55) took this to mean that a later written report was made. We think it more likely that this sentence means that Beall was going to report in person to headquarters. The January 1857 Post Return for Fort Tejon (Post Returns from Military Posts, Records of the Adjutant General, Record Group 94, U. S. National Archives microfilm MC 617, roll 1257) shows that Beall received a letter from headquarters on January 8, ordering him to report to San Francisco for duty at a court-martial. It would have been natural for Beall to acknowledge this order in his next letter to headquarters. We have found no other material in the 1857 correspondence of the Department of the Pacific relating to earthquake damage. The only report made by the San Francisco headquarters is a letter to the Adjutant General's office in New York. (General J. E. Wool to Lt. Col. L. Thomas, January 17, 1857, Letters Received by the Office of the Adjutant General, Main Series, 1857, Records of the Adjutant General, Record Group 94, U. S. National Archives microfilm MC 567, roll 565, frames 353-359). This includes a copy of Beall's letter but no further information.

24. Portion of MS "Report of Labor on Sebastian Military Reservation" (Letters Received, California Superintendency, 1857, Records of the Bureau of Indian Affairs, Record Group 75, U. S. National Archives microfilm MC 234, roll 35, frame 1027)

Friday Jan'y 9th — In the morning experienced a tremendous shock of Earthquake, which damaged the greater portion of the houses and threw down one.[1] Ten slight shocks during the day.
Saturday Jan'y 10th — Shocks continue.

Notes

1. The Sebastian Military Reservation (also known as the Tejon Agency, or Tejon Indian Reservation) was located at the mouth of Tejon Canyon, in the southeast corner of the San Joaquin Valley (Boyd, 1972).

25. Portion of a letter from Thomas P. Madden to Col. Thomas J. Henley, Tejon Agency, September 20, 1857, entitled "Labor Report for Tejon Reservation for the 3rd quarter 1857" (Letters Received, California Superintendency, 1857, Records of the Bureau of Indian Affairs, Record Group 75, U. S. microfilm MC 234, roll 35, frame 1287)

The public buildings — all of them need repairing, more or less. The large granary was very much injured by the recent earthquakes, more so than was at first supposed. The whole north end of the building has bulged out and the top adobes immediately under the peak of the roof have fallen. It is the general opinion that unless something is done for its preservation before the rains set in the entire north wall will fall during the approaching winter. The Goat house near Bicente's Rancheria needs roofing and the chimneys rebuilt, the latter having crumbled away by the action of the Earthquakes and the weather.

26. Visalia *Weekly Delta* November 26, 1859

The curiosities are the Hot Springs on the opposite side of the river from Keyesville,[1] the water of which is almost boiling hot where it comes up through the ground. The spring runs a large sluice head. The taste of the water is very similar to that from the Blue Lick Springs of Kentucky. We were told that during

the time of the earthquakes of 1857 the water from this spring was intensely hot, and continued so for some six months after. There was another spring some fourth of a mile distant, which was entirely closed up by the earthquake, and is now dry ground where it once run.

Notes

1. Gudde (1975) locates Keyesville 6 kilometers west of Isabella. There are a number of hot springs along the Kern River in this area.

27. Reminiscence by Stephen Barton, 1876 (From the Visalia *Iron Age*, December 28, 1876, p. 1, col. 2)

During the fall of 1856[1] the heaviest earthquake shock which has ever been experienced in this valley occurred. Houses and trees vibrated furiously, and most of the population were seriously frightened. The solid earth seemed to have lost its stability, and a wave-like motion was experienced, as if on ship-board. Lowing herds capered over the plain; wild fowls rose in the air with screams, and for a moment nature seemed filled with horror. The line of disturbing force followed the Coast Range some seventy miles west of Visalia, and thence out on the Colorado desert. This line was marked by a fracture of the earth's surface, continuing in one uniform direction for a distance of some two hundred miles. The fracture presented an appearance as if the earth had been bisected, and the parts had slipped upon each other. Sometimes the earth on one side would be several feet the highest, presenting a perpendicular wall of earth or rocks. In some places the sliding movement seems to have been horizontal — one side of the fracture indicating a movement to the north-west, the other to the south-east. The fracture pursued its course over hill and hollow, and sometimes this sliding displacement would give to the points of hills and to gulch channels a disjointed appearance.

Notes

1. As Wood (1955, p. 49) pointed out, this is almost certainly an error for winter 1857.

28. Reminiscence of John Barker, ca. 1900[1] (From California Federated Women's Clubs, History and Landmarks Section, 1913)

In 1857 I was a young man of twenty-five, and for four years had lived on a cattle ranch through which Kings River ran. Its source was near Tulare Lake. The only settlement between Los Angeles and Stockton, at that time, was the hamlet of Visalia; so neighbors were far apart.

One morning in the month of November, 1857,[2] I started out on horseback in company with an old Englishman my nearest neighbor, to search for some horses of ours that had strayed away. We shaped our course to skirt the shores of Tulare Lake between what is known as Cross Creek and Kings River.

At this time Tulare Lake was a very large sheet of water, about one hundred miles in length by thirty miles in width at its widest place. For a couple of miles from the shore, the waters in the shallows were covered with burnt tules and other refuse matter unfit for use for man or beast, until a distance of two miles from the shore was reached.

We knew that our horses would not drink from the lake, but there were sloughs and holes of water in depressions outside of the lake, where the water was clear and fit for use.

To one of these water-holes, which was surrounded by a fringe of tall willows, we directed our course in order to look for tracks of our missing stock. As several of them were shod, we knew if we found the shod tracks that we were on the right trail.

There was a keen frost, and when we reached the water-hole a thin film of ice was seen upon the water. I dismounted and led my horse by the bridle, and walked to the edge of the water. Just as I reached it, the ground seemed to be violently swayed from east to west. The water splashed up to my knees; the trees whipped about, and limbs fell on and all around me.

I was affected by a fearful nausea, my horse snorted and in terror struggled violently to get away from me, but I hung to him, having as great a fear as he had himself. Of course, all this occupied but a few seconds, but it seemed a long time to me.

The lake commenced to roar like the ocean in a storm, and, staggering and bewildered, I vaulted into the saddle and my terrified horse started, as eager as I was to get out of the vicinity. I found my friend, who had not dismounted, almost in a state of collapse. He eagerly inquired, while our horses were on the run and the lake was roaring behind us, "What is this?" I replied, "An earthquake! Put the steel to your horse and let us get out of this!" and we ran at the top of our speed for about five miles.

We observed several hundred antelopes in a state of the wildest confusion and

terror. They ran hither and thither, creating a great dust, stumbling and falling over each other in mortal fear. It is their habit at this season of the year, while rearing their young, to congregate in great numbers for mutual protection from coyotes and other vermin; the males also herding in bands by themselves until the new grass starts.

We returned next day and found that the lake had run up on the land for about three miles. Fish were stranded in every direction and could have been gathered by the wagon-load. The air was alive with buzzards and vultures eager for the feast, but the earth had acquired its normal condition.

We can only imagine what the consequences would have been if a great city had stood upon the eastern shore of the lake.

Notes

1. The book containing this account is undated; Eisman (1972) suggests that it was printed in 1913. Many of Barker's reminiscences (though not this one) were published in newspaper articles in 1904 (Boyd and Rogers, 1955) and we have therefore given a date of about that time. Barker died in 1909.
2. Undoubtedly a misremembrance of the date. Note that the season given is correct.

29. Meteorological Report for January 1857, Fort Miller, California[1] (Climatological Records, Records of the Weather Bureau, Record Group 27, U. S. National Archives, Washington, D. C.)

Three distinct and very perceptable shocks of the earth ~~was~~[2] felt this morning (the 9th) at 8 A.M. a slight tremor occured during the night previous at 2½ A.M.

Notes

1. Our location for Fort Miller is from Whiting and Whiting (1960). The site of the Fort is now beneath Lake Millerton reservoir.
2. This word is crossed out in the original.

30. Diary of Dr. C. A. Canfield, January 9, 1857 (From Holden, 1898, p. 49)

...15 or 20 miles N.W. of San Benito, Dr. Canfield's Diary[1] says 3 shocks, the first about sunrise,[2] lasting not over 5 seconds, accompanied by noise. The second about 8 a.m., "very much more violent — pieces of mortar fell from the walls — I was almost thrown from my seat — this lasted for a minute or two and I then went out of doors, when the oscillation returned and lasted perhaps a minute, but was quite gentle." The direction was S. to N. A person lying down reported a shock at 10 a.m., which was not felt by persons in motion.

Notes

1. Holden (1898, p. 3) specifies this more fully as the diary of "Dr. C. A. Canfield, who lived 15 or 20 miles northwest of San Benito, Monterey County". We have not been able to locate this document, or any more precise reference to Canfield's location.
2. 7:23 a.m. (Holden's note).

31. Santa Cruz *Pacific Sentinel* January 10, 1857 p. 2, col. 1

Yesterday morning was experienced two severe shocks of an earthquake, the first between 5 and 6 o'clock A.M., and the other about 8 o'clock A.M., which lasted for several seconds, and caused a shaking of things generally. As yet, we have heard of no damage resulting from them.

32. Santa Cruz *Pacific Sentinel* January 31, 1857 p. 1, col. 5

The shock of earthquake, or rather earthwave was felt in the counties of Santa Cruz and Monterey, on Friday morning, the 9th inst. It came from the west and north, and its direction was to the south and east. It was a pretty hard shock, yet no buildings were affected, and many persons did not even experience its movement and were entirely ignorant of its occurrence until informed of it. We understand from other parties that shocks were felt also at one o'clock A.M., and another at 8 o'clock A.M.

33. Santa Cruz *Pacific Sentinel* January 31, 1857 p. 2, col. 7

The Earthquake or Wave of the 9th of January

Our readers will find to-day, on our first page, the most corrected accounts yet published. It appears from what we have observed of the phenomena and the observation of our friends in Monterey county, that three distinct shocks were experienced — the first at one o'clock A.M., the second which was the sharpest, at seven A.M., and the third at 8 A.M. The vibrations were all undulatory, coming from the North and West, and passing directly to the South-East. On the Salinas river and the lagoons of the plain, at the 7 A.M. shock, the waters were much agitated — the trees on the banks were tossed to and fro with violence, chains around carts, houses and walls set up a-rattling; dogs a barking; men and women startling, and horses to get wild, rearing and snorting. In taking into consideration the exact time of the visitation of these earthwaves, and the great discrepancy in the accounts of the different observers throughout the State, it must be borne in mind, that out of San Francisco, and Sacramento, (where there are proper chronometers corrected daily for science and navigation) there are not two watches which keep the same time — generally they differ by fifteen minutes, and often half an hour.

34. Santa Cruz *Pacific Sentinel* February 21, 1857 p. 2, col. 2

The earthwave which occurred on 9th ultimo visited the southern part of Monterey county with great force. We understand, that at the Ranch of San Benito, fifteen miles east of San Antonio Mission, the force of the shock was so violent, that every person in the house, which is a heavy adobe and stone affair, involuntarily ran out into the open air with great fright, except an old gentleman who was laying very ill, and his wife who was attending him, and who in the extremity of peril, clung to the old man with a most rare presence of mind. The old man is an Englishman, the old lady is a Californian. — The oldest son, a strapping boy of twenty-two, with a strong revulsion of feelings, rushed back into the house and took up his father, to carry him off, when the shocks ceased, and the family became quiet.

The rancho is about twenty miles from Monterey,[1] and lies in a line with the Tejon pass, of northwest and southeast — which we conceive, is the indubitable direction the seven o'clock shock followed.

Notes

1. This is not correct. The San Benito land grant, which does lie 25 kilometers (16 miles) northeast of Mission San Antonio, is about 90 kilometers (55 miles) from Monterey (Beck and Haase, 1974, map 31).

35. San Jose *Telegraph* January 13, 1857 p. 2, col. 3

On Friday morning at about five minutes past eight o'clock, a severe shock of an earthquake was felt in this city. The movement was undulating and slow, and seemed to proceed from southwest to northeast, and produced a sickening sensation precisely as one feels when upon the rocking waves. We were standing in front of the fire at the time of its occurrence, and so much and so suddenly were we affected by it, that a fainting dizziness came over us, and we were obliged to recline upon a sofa. The vibrations were slow and gradual, and continued for about a minute. The effect upon some of the artesian wells in this neighborhood was remarkable — for a moment the water ceased to flow from the pipes, and then gushed out in greater volume and with more power than usual; we have heard that the channels of other wells, which had become obstructed, and ceased to discharge water, have become re-opened and the subterranean current is now flowing out from the orifice. It is said that at five o'clock, and again at about six, of the same morning, very distinct shocks of an earthquake were felt, but the motions were short and quick.

The shock was heard with equal violence at San Francisco and Sacramento and has doubtless been perceived for a great distance along the Pacific coast.

36. San Jose *Tribune* January 14, 1857 p. 1, col. 2

At about four o'clock on Friday morning last, Jan. 9th., a pretty severe shock of an earthquake was felt in this city, and a still stronger one on the same morning at about half past eight. The vibrations were from East to West, and continued for the space of nearly if not quite, a minute. The San Francisco papers state that the shock was felt there at a few minutes after 8 o'clock; and a telegraphic dispatch from Sacramento announced that it came off in that city between 7 and 8. If such was the relative time of the occurrence of the phenomenon, we would request our friends in Sacramento on the next repetition of the performance, to send us a telegraphic dispatch forthwith; which will enable us all in this section

of the State to be prepared for the catastrophe. Those of us particularly who dwell in houses of brick or adobe, would much prefer to step out on such occasions into the street, and there quietly wait for the wagging, rather than to be surprised within four trembling walls of untried solidity, and compelled either to watch suspiciously the vibrations, and calculate our chances of being buried beneath the ruins of our own domiciles, or else to compromise our dignity by rushing incontinently forth into the open air.

The effect of the motion in San Jose was such as to produce in almost every one to whom we have spoken on the subject a severe nausea, in several instances even to vomiting, and a similar effect is said to have been produced on certain hotels and boarding houses, which threw out the contents of their breakfast saloons with emetical precipitancy. At Hillman's Temperence House, when the Earthquake motion was laid on the table, the motion to adjourn to the street was immediately put, and unanimously carried. And we have been informed of another instance, where several strangers who were just finishing their breakfast at one of the city restaurants, were so alarmed by the unwonted movements of the knives and forks, that they not only gathered up their hats and rushed out of the room, but altogether forgot to return and settle their bills.

To speak seriously however, the only important damage effected by the earthquake in this valley that we have heard of was the cutting off or reducing in volume the streams of several of our artesian wells. In some instances the water has entirely ceased to flow to the surface, and in others the stream was for a time greatly increased, and then subsided to about its former size. This was the case with the well at the distillery; while the public fountain on Market St. has been permanently reduced in its volume.

With regard to the operation of the shock on the large brick edifices of the town, we deem it worthy of notice, that while the Post Office building, which is regarded as the most solid and substantial structure in the city gave manifest indications by the creaking of the timbers, of the severity of the vibration, the City Hall moved quietly to and fro without any such noises occurring — a pretty good proof that the fears entertained by some concerning the stability of our buildings are groundless.

37. San Francisco *Daily Alta California* January 10, 1857 p. 2, col. 1

A severe shock of an earthquake was felt in this city yesterday morning, a few minutes after 8 o'clock, causing a considerable degree of consternation and alarm, particularly in the lower part of the city, where the shock was more severely felt than in the upper portion. A frame house, situated in the rear of the intersection of California and Market streets, occupied by Peter J. Evans and family, was shaken from its foundation and moved several feet to the southward. The house was elevated some four or five feet from the planking, and stood upon piles; beneath it were placed a number of barrels and boxes. When the under-pinning gave way, the floor of the house rested upon the boxes and barrels, and was broken through in several places. A little girl who was in the house, asleep at the time, narrowly escaped, as the floor beneath her bed was broken through. The shock was generally felt throughout the city — clocks were stopped, gas burners were shaken, crockery and tin rattled in the stoves, and at a hotel on Davis street, where the boarders were breakfasting at the time, the shock was so severe that men, women and children left the table and rushed to the street. By telegraph from Sacramento, we learn that the shock was felt in that city between 7 and 8 o'clock A.M. About a year ago, a similar, though much more severe, shock was felt in this city. It is stated that no less than sixty shocks of earthquakes have been felt in this city within the past five years.

38. San Francisco *Daily Alta California* January 13, 1857 p. 1, col. 1

This day will long be remembered by the people of Santa Barbara.[1] We have had six shocks of an earthquake up to this minute, two since I commenced writing, consequently my nerves are not in as good order as usual. The first shock was at six in the morning, the second at nine, one and a half minutes in duration, the most severe shock ever felt in this part of the country. Scarcely a house in town that escaped damage; people and animals were thrown down — the earth opened in many places — water gushed up some places seven feet — the water in all the wells arose from ten to twenty feet — people frightened badly at every shock. Third shock at ten, slight — the three last this evening, two slight, one heavy. If we have many more, we shall begin to think we are going elsewhere.

Notes

1. This is from a letter of R. E. Raimond, of Santa Barbara, dated January 9, 1857.

39. San Francisco *Daily Alta California* January 28, 1858 p. 1

SANTA BARBARA.[1] – The morning of the 9th January, was ushered in with a clear sky and cool atmosphere. First shock of earthquake felt at 8:10 A. M. It was brief and passed unnoticed by many. At 8:22 A. M., the heavy shock occurred and continued from 40 to 60 seconds. The inhabitants in the city generally fled from their dwellings. There were two motions during its continuance. The earth vibrated from side to side, accompanied by a peculiar rolling motion like that experienced on a vessel at sea. In-doors the creakings of the house roof resembled the noise like that of straining timbers of a ship in a gale. The vibrations seemed to come from the N.E. and proceed to the S.W. There was no rumbling or other sound during this earthquake, or any other succeeding shocks felt here. No damage ensued beyond cracking a few adobe house walls. At the sea-beach, water and mud spouted up out of the ground to the height of several feet. Several new springs were caused in the mountains by this earthquake. Throughout the entire day and evening the earth seemed at times disturbed by tremulous vibrations. The sensation experienced by the writer during the above heavy shock, was as if the centrifugal motion of the earth had been suddenly checked, and for the time being, thrown from its accustomed equipoise.

SACRAMENTO. – The *Sacramento Union* says: "The earthquake of Jan. 9th was felt at 2:15 A. M. and 8:15 A. M.[2] The last shock was of few seconds duration, but sufficient in force to cause chandeliers to vibrate about a foot from the centre, and to create a rattling among crockery and other wares. The motion seemed to be *from W. to E.*, like successive undulations." Another account in the same paper states that the vibrations seemed to proceed *from S.E. to N.W.* Thos. M. Logan, Esq., states that the motion of the earth was horizontal, and the intensity of the earthquake force sufficient to cause chandeliers to vibrate a few inches from the centre. From all accounts, it would seem that the terrestrial wave came *from W. and N.* and made its way to *S. and E.*[3]

The "other phenomena, &c." in connection with the present topic, will be given in a future article.[4] Respectfully yours,

C. H. Randall

Notes

1. This is part of a very long article describing the effects of the earthquake throughout California. With the exception of the part describing the effects at Santa Barbara, which is an eyewitness account, the reports are taken from other newspapers and are therefore secondary material. It should be noted that C. H. Randall, the author of this account, was also an editor of the Santa Barbara *Gazette* (see the *Gazette*, January 15, 1857), so that this account is not independent of those in that newspaper, reprinted here as (20) and (21).
2. The original account (65) says 10:15 A.M.
3. This conclusion would appear to be Randall's.
4. This article was published in the *Alta* of February 8, 1858. It contains no useful material.

40. San Francisco *Daily Evening Bulletin* January 9, 1857

Earthquake This Morning. — Several shocks of an earthquake were felt in San Francisco last night and this morning, the principal one occurring at a quarter past eight o'clock this morning. The shock seemed to be much more severe in the lower than in the upper part of the city. The printers of the *Bulletin*, in the third story of a building on Merchant Street, being at work at the time, felt the house trembling and moving. One of them grabbed his coat to run; another was in such great tribulation that he could not find his hat. "The fat man," thinking there was no chance for escape, held on to a printing case, perfectly resigned to his expected fate. In some of the hardware stores in the lower part of the city there was a great clashing among the crockery and tin pans. Several clocks were stopped. In a house on Second street, a lady who had lately arrived on the *Orizaba*, said that the motion of the house resembled that of the vessel at sea. An ironing board, five feet long, which was hung up against the wall, vibrated to and fro several times. The shock, however was not so severe as that one which occurred last spring, and many persons did not notice it at all ...What between fire and earthquake it is hard to say whether wooden or brick houses are the safest to live in.

41. San Francisco *Daily Evening Bulletin* January 12, 1857 p. 2, col. 2

Our regular Los Angeles correspondent, "Observador",[1] (whose letter will be given in full to-morrow) writes:

"A severe shock of an earthquake was felt here this morning [Friday, 9th January][2] at half past eight o'clock. The motion seemed to be East and West. The motion of the earth resembled the long swell of the sea — it literally swayed backwards and forwards like the rocking of waves, so that it was with great difficulty one could stand up. Articles hung overhead in houses, swung to and fro like so many pendulums. Clocks were stopped. The water in the river and *zanjas* was turned back or overflowed the banks. The people generally fled from their homes into the open air. The vibrations apparently did not cease for some minutes. The damage done to buildings was slight, as the motions were *long* and lateral, instead of sudden, violent, and vertical. Almost an hour later another shock was felt."

"A. S. T." of Monterey, so well known as a writer on California topics and a man of science,[3] writes us on the same subject as follows:

"A smart shock of earthquake — apparently a wave coming from the West and North, and making its line for the South and East — was felt in Monterey about 7 o'clock in the morning of Friday, the 9th inst. It shook some of the oldest adobe buildings in the town, but did no harm whatsoever to things animate or inanimate. The earth seemed moved with the motion of a heaving, rolling wave. It was certainly a horizontal movement, and not a vertical one. Many people in the town, who were about their occupation, did not experience the sensation in the slightest degree; while those who were in bed felt it distinctly."

Notes

1. H. D. Barrows; compare his reminiscences (16).
2. The bracketed material is in the original.
3. Alexander S. Taylor, California historian and bibliographer.

42. San Francisco *Daily Evening Bulletin* January 13, 1857 p. 2, col. 2

As the late earthquake did not do any serious damage in this immediate vicinity,[1] many persons ... were not aware of its occurrence until they read of it in the papers.

Notes

1. This is part of a letter from Sacramento, dated January 12, 1857.

43. San Francisco *Daily Evening Bulletin* February 3, 1857

Los Angeles, January 28, 1857

We have been having exciting times in the Southern country since the last steamer left. The great earthquake felt here on the morning of the 9th inst. was rather more extensive in its operations than we at first anticipated; it did some appalling execution in various localities in this vicinity. At Temple's Ranch, twenty miles south of this point,[1] the ground opened several feet wide for some distance, partly in the bed of the San Gabriel river and partly across the stream. At Paredes, thirty-five miles south-east,[2] the ground cracked and several streams of water commenced running. At San Bernardino, and on the Mohave, the shock was tremendous, but we have heard of no disruptions. In various places streams have started where no water ran before the convulsion, and Mr. Stanley, of Capt. Greenwell's coast surveying party, (a gentleman who may be relied upon,) reports that he discovered on the side of a high mountain in the vicinity of San Fernando, a "fissure in the rocks from which hot gas was fiercely issuing. The rocks and ground were almost too hot to be touched."[3] In the vicinity of Fort Tejon, 100 miles north of Los Angeles, (from which place you have doubtless heard ere this) the effects of this convulsion of nature seem to have been the most violent. The ground opened in places for thirty or forty miles, and from ten to twenty feet wide! The line of disruption runs nearly north-west and south-east in an almost straight line, passing near Lake Elizabeth. The ground appears to have opened in the form of a *ridge* and then to have fallen back, leaving the earth pulverized and loose about twelve feet wide generally, so that in many places it is almost impossible to pass. An eyewitness saw large trees broken short off near the ground; he saw cattle roll down steep hillsides from the violence of the shake; he had to hold on to a post himself to stand up. The people in the Fort were unceremoniously honored with a shower of plastering and a general tumbling down of walls and chimneys, and it seems providential that none of them was killed. He judged that it would take months to repair the buildings at the Fort. The officers and men are now camping out in tents. At the Reservation much damage was done, but I have not heard particulars. The body of the woman killed by the falling of the house at Reed's Ranch, was brought to Los Angeles and buried; her head was badly bruised. Quartermaster Wakeman reports the time of the shock at twenty-

seven minutes previous to 9 o'clock, which agrees very well with the time as noted here. The motion was preceded there, and accompanied here, by a heavy rumbling report.

There are no signs of aught being thrown up from the openings at Tejon. It is supposed that though the causes of these disturbances may be subterranean fires primarily, the secondary and immediate causes are the escape or explosion of gases generated by those fires. This we conclude from the *entire absence* of all signs of volcanic matter, although the disruptions of the earth and the force that caused them, in the movement of the earth on the 9th instant, were tremendous.

We had at Los Angeles five or six shocks during the same day and night, and within about eight days time we had *twenty* shocks – some violent, some light. Since that time we have had none to speak of. For about a week we were "well shaken" and expected to be "taken," as the doctors phrase it. Reports were constantly coming in of the doings of the first great *temblor* in the sections of the country about us, interspersed with "lesser shakes" of the earth, so that the public nerves were kept up to rather an uncomfortable tension.

– Observador[4]

Notes

1. See (14, n. 1).
2. Meadows (1966) says this was on the edge of the Santa Ana River 800 meters east of Brookhurst, in what is now Fountain Valley.
3. This quote is from the Los Angeles *Star* (14).
4. H. D. Barrows. See (16).

44. San Francisco *Daily California Chronicle* January 10, 1857 p. 2, col. 2

A shock of an earthquake was felt in this city yesterday morning about eight o'clock. It seemed to commence on a range with Clay street, and spread towards Rincon point, and was felt in Sacramento. Singularly enough, none of the vessels in the bay north of the line of Clay street shook in the least, while on vessels south of the line the shock was quite severe. Clocks were stopped, tin pans and articles of crockery upset, frame buildings trembled, and brick houses were considered dangerous. A great many people were frightened, but no one was hurt. "Gabriel" did not come this time, although there was a general "rattling of the dry bones," and people ran out of their rooms without stopping to attire themselves in full dress. No buildings were cracked or injured that we have heard of.

45. San Francisco *Daily Morning Call* January 10, 1857

At about half-past five o'clock yesterday morning, a slight shock of an earthquake was felt, and at eight o'clock, another much more severe. The last frightened a good many people, and occasioned some little damage. A small frame building on "stilts", was thrown over, several piles of lumber changed positions, a few plates from the breakfast table of a hotel on Front Street were thrown on the floor, and some of the compositors on an eveningpaper were only prevented from breaking their necks by jumping out of a third story window to avoid the danger to life by the falling in of the roof, by their more cool and collected fellow-craftsmen. It was in reality such a shock as to furnish a good item for our local. The shock was sensibly felt in Sacramento at the same instant.

46. San Francisco *Daily Globe* January 10, 1857

A slight shock of an earthquake occurred in this vicinity yesterday morning, at fifteen minutes past eight o'clock. The shock lasted about twenty seconds. The motion was undulating and ranged from North to South. From all that we can learn, the shock was most severe in the neighborhood of Happy Valley,[1] where the people rushed out of doors and a scene of general consternation prevailed for some minutes. Those who experienced the shock were reminded of the earthquake which happened on the morning of the 15th of February last year.

Notes

See (72, n. 2) for the location of this place.

47. San Francisco *Daily Herald* January 10, 1857 p. 1, col. 2

At five o'clock, yesterday morning, and again at fifteen minutes after eight o'clock, the earth was shaken to its centre by the throes which seem to have become a part of the peculiarities of our State.

The motion of the earth is as variously described on this as on former occasions — some contending for north and south as the direction of the movement, while others insisted on east and west, and others still — though fewer in number — for all the

possible combinations of the points of the compass; — though it is universally conceded to have been felt with greater violence in the south part of the city and that part reclaimed from the Bay — all below the former water-line being particularly susceptible. Subjoined will be found such incidents of the result of the shock as could be obtained:

INCIDENTS

The clock in the office of the Pacific Express Company, on the corner of California and Montgomery streets was shaken from an upright position and did not recover its perpendicular. One of the hands was loosened so that it fell from the face.

In the store of Morgan, Hathaway & Co., a large pile of tea-boxes were thrown down by the vibration, and gave evidence of the severity of the motion in that neighborhood.

On Steuart-street wharf the shock produced an emptying of the houses of their human contents — upwards of fifty persons ran frightened and confused into the street.

The Rassette House was not exempt from the visitation, and the inmates were no less frightened than when canvassing the effects of the February shake.

On Market Street a small frame house was shaken from its foundation and fell a distance of five or six feet — though it is probable a high wind would have done as much for it just at that time.

In the lumber yards the boards not securely placed were toppled over; and in the whole lower part of the city light articles of furniture were moved from their positions, crockery crashed on shelves, glasses jingled in cupboards, water slopped in pails — and all the accompaniments of a second-class earthquake were experienced.

48. San Francisco *Daily Herald* January 12, 1857 p. 2, col. 1

From passengers by the steamer Senator, we learn that the earthquake, on the 9th inst., felt in Sacramento and this city, extended to the southern coast, was the most alarming experienced for the last half century. In San Diego, Santa Barbara, Los Angeles and San Pedro, it was peculiarly severe, and continued for upwards of twenty minutes or a half an hour. They represent the motion as from north to south. In all the places named, several houses were cracked — the people rushed out into the streets — but as most of the dwellings in that section of the country are one-story adobes, stoutly built, no injury to life ensued. From the representations made to us, we have not the slightest doubt that if the earthquake was as severe in this city as in

the southern portions of the State, San Francisco might possibly have been in ruins to-day. In San Diego, houses were thrown to the ground[1] — moveables were scattered about in the wildest confusion, and for a time intense excitement prevailed.

TERRIBLE EARTHQUAKE DOWN SOUTH. — It seems there has been a terrible Earthquake down South. The papers received by the Senator from Los Angeles are only to the 3d of Jan., and Santa Barbara to the 8th, therefore no mention is made of it. From a private letter dated Santa Barbara, Jan. 9th, received by a gentleman in this city, we have been permitted to make the following extract: "One hour past we had shocks of the most terrible earthquake experience for the last forty-six years in California. They lasted some twenty minutes. Several houses were injured but no lives were lost. The inhabitants all fled from their houses. For a time I could scarcely keep on my legs. It occured at 8¼ o'clock this morning (the same time the second shock was felt in this city. — ED. HERALD.) God help you if it should be felt in San Francisco just as here. It would be a heap of ruins."

Notes

1. This report of severe damage in San Diego (unfortunately widely copied) was shown to be false by Trask (55).

49. San Francisco *Daily Sun* January 10, 1857 p. 2

On just such a morning as that of yesterday, on the 15th of February, now nearly one year, our city was visited by a most severe shock of earthquake. The weather was not as cool at that time, but the sun rose in cloudless majesty, and the shores of Contra Costa appeared as if not more than half a mile distant. Very little air was stirring, and nature seemed hushed in quiet repose. Within the last twenty-four hours we have again felt the upheaving of Earth's foundations, and although the shock, or rather tremors, were not very severe, yet they were sufficiently so to cause much agitation to some persons. They seem to have been more severely felt in the lower portion of the city. The first shock was at 11 o'clock and 20 minutes, P.M.; the second at 1 o'clock and 33 minutes, A.M.; the third at 4 o'clock and 15 minutes; the fourth at 6 o'clock and 8 minutes; the fifth at 7 o'clock precisely, and the sixth at 8 o'clock and 14 minutes. The tremors of the fifth shock, four in number, produced a circular motion of the pendulum, and in the other five, the oscillations were apparently from northeast to southwest. The last shock was much the strongest, and created considerable alarm. The scenes that occurred on the 15th February, 1856, seemed about to

be re-enacted, and many persons ran out of their houses on experiencing the shock.

Earthquake in Sacramento — A severe shock of earthquake was experienced in Sacramento yesterday morning. It commenced at nineteen and a half minutes past 8 o'clock, and lasted a few seconds short of four minutes, being very sensibly felt. Its oscillation appeared to be from southwest to northeast. The acme or severest tremble seemed to be about the middle of the "shake." From the statement of a gentleman who came down on the boat last evening, it appears that it was fully as sensible as that felt in this City in February last. The weather was excessively cold, and the thermometer was far below the freezing point. The sky was almost cloudless.

50. San Francisco *Daily Sun* January 20, 1857 p. 2

The agent of the Pacific Express Company, at Mokelumne Hill, has kindly given us some valuable information in regard to the shocks of earthquake experienced at that place on the night of the 8th inst. He says:

So firmly are we fixed upon the bosom of mother Earth, that severe indeed must be the shock which can disturb our equanimity, or in fact, our equilibrium; but on the night in question, we were suddenly aroused and many seriously alarmed by a rapid succession of slight shocks, which caused our windows and doors to rattle as if they were breaking. The shocks were accompanied, at intervals, by flashes of light, from east to west. These were witnessed by many persons, who were aroused from their slumbers, and had assembled in small knots to speculate on the unusual occurrence. A committee was appointed, including many of our scientific and professional citizens to investigate the phenomenon, and in a few moments it was ascertained that a jubilee had been declared for the election of our esteemed friend, Mr. Broderick.[1]

This was all we saw, heard or felt of earthquakes, until the arrival of the Stockton stages on the day following.[2]

Notes

1. David C. Broderick. Bancroft (1888, pp. 705-706) gives the details of his election as Senator. Though not actually elected by the legislature until January 9, he had been nominated by them in caucus before, so a celebration on the night of the 8th and 9th is perfectly comprehensible.

2. The jocular tone of this piece makes it hard to tell if any earthquakes were felt or not. From this sentence it appears that the main shock was not felt.

51. San Francisco *Daily Sun* January 24, 1857 p. 2

"The Late Earthquake"

At the time of the occurrence of this phenomenon, we had some doubts of the extent of its action, as reported by the morning papers of this city, and therefore have taken some pains to ascertain the facts relating to it in this particular. Through the kindness of the Pacific Express Company, who have forwarded letters of inquiry for us throughout the interior, we are now enabled to state that in no locality east of Stockton and Sacramento, and north of Marysville was any shock felt whatever. In neither of the mountain towns that were paraded in the columns of the city press was there any occurrence of the kind.

52. San Francisco *Daily Town Talk* January 10, 1857 p. 2, col. 4

The prevalent cold weather has had an effect on Mother Earth, who, during the night of Thursday and early yesterday morning, evidenced the power of the chills. At eleven o'clock on Thursday night the first shock occurred, a moderate one ensued, and we suppose the old lady took a tissane and retired. The effects of the Thompsonian cure, however, passed off by sunrise yesterday, and at seven o'clock the paroxysm returned, being followed by a severer one at twenty minutes past eight. All three shocks were perceptibly felt in our vicinity, and the latter traveled as far as Sacramento. The vibrations of the second shock were north and south, those of the third, three in number, were more violent in effect, and moved from east to west. The pictures on the walls rattled, clocks stopped, and in one instance a pile of merchandise in a store, in the lower part of Clay Street, was thrown to the ground. The effects were more severely felt in the entire northern section of the city. On Powell Street the sensation affected those at breakfast, causing dizziness and nausea. We have not heard of any serious damage except to nerves. A gentleman residing on Minna street informs us that he determined the direction of the shocks and the extent of the vibrations from the results of the same on the material of his breakfast table, while engaged in his matinal meal, previous to the last shock. A plate of beefsteak, swimming in gravy to its very edge, was the instrument. After the motion ceased, it was found that the gravy had been ejected from the dish on two sides for about two inches each way, in a line east and west by the compass. The distance thus mapped on the table cloth, from the edge of the dish, clearly demonstrated the extent of the vibrations. Who will work out this problem from the start?

53. Portion of a letter from George Davidson to Alexander Dallas Bache, San Francisco, January 19, 1857 (Vol. 16, Superintendent's Correspondence for 1857, Records of the Coast and Geodetic Survey, Record Group 23, U. S. National Archives microfilm MC 642, roll 169, frames 164-165)

We had an earthquake here on the morning of the 9th. 1st shock about 7¼ A.M. second and more violent about 8¼ A.M. The latter toppled over piles of lumber, threw down a small frame building and one of my friends witnessed a large can buoy rolling about the wharf. I have not been able to get any reliable means of showing its force and direction, but am certain the motion was from W.S.W. to E.N.E. (Mag) or vice versa or nearly in the direction of the E. & W. streets in the North part of San Francisco. It occurred at Santa Barbara and San Diego later in the A.M.

54. Reminiscences of George Davidson, 1906. (Conflation of the quoted material in Lawson *et al*, 1908, p. 450, with extracts from Davidson's MS notes dated May 25, 1906, in folder 4 (Earthquakes and Volcanoes), Davidson papers, Bancroft Library, Berkeley)

We have no reliable record of the times of the shock at different points, and very little of the direction. Means of communication were underdeveloped. The times were local at the places where it was recorded.

It occurred at San Francisco $8^h\ 13^m\ 30^s$ on the morning of Friday, January 9th; and was marked by one sudden sharp shock from the northward; minor details I have kept no recollection. A friend lying in bed east to west was thrown out sideways; I was lying North to South and disturbed also by the shock. Our boarding house was just on the east side of St. Mary's Cathedral.

The wholesale grocery store of Goodwin Brothers faced east on Battery or Front Street, with its length of about 100 feet on Commercial Street. It was a 1-story brick structure about 15 feet high, with a flat metallic roof and a fire-wall of 3 or 4 feet above and around the roof. There were no windows nor doors on Commercial Street. The fire wall along Commercial Street was thrown bodily from the main structure into the street. The inner edge of the bricks was a straight line, at a measured distance of 6 feet from the base of the wall, while the general mass was scattered across Commercial Street. In the hardware establishment of Philip T. Southworth, along the west side of the east wall, there was a line of nail kegs, every one exactly 12 inches from the baseboard. Before the shock they had been placed close to the baseboard. These two conditions would indicate a movement of the earth from the

northward and westward – roughly, from the north-northwestward. I do not remember damages to other buildings, but am satisfied there were no serious results to property. Among minor details were the effects of the shock upon one of the piled wharves, where a lot of bar-buoys had been left. They had been rolled about in every direction.

55. Extracts[1] from a paper read by Dr. John B. Trask before the California Academy of Natural Sciences, San Francisco, March 30, 1857 (First published in *Proc. Calif. Acad. Sci.*, 1, 109-110; republished as Trask, 1858)

Immediately following the occurrence of the phenomenon, letters were addressed to all the principal towns between Mariposa and Downieville, east of the valleys, for the purpose of learning how far the shocks may have extended eastward of this city. These letters were forwarded by the Pacific Express Company to their agents, and through them answers were returned in every case but two through the same source. From the facts thus obtained, it was found that in no locality east of the foothills, *was any shock felt whatever on that day or night.*[2]

Another report, equally unfounded, reached us on the arrival of the steamer from the southern coast, to the effect that several houses had been demolished in San Diego from its violence, while the facts in the case are, *that the steamer left that port twenty-four hours before the shock occurred there.*

I have been able to determine with considerable accuracy the period of time at which the shock between eight and nine o'clock in the morning of the 9th took place . . . as the shock at that hour seems to have been more generally noticed than those which either preceded or followed it here or elsewhere, though at this city it was much less marked than the shocks at 1h. 33m., 4h. 15m., and 7h., these three latter occurring at those hours of the morning when most persons are sleeping. The shock at 7h., produced a circular motion in the pendulum, the diameter of which was about five inches. The oscillations of the pendulum in all the others were in an easterly and westerly direction.[3]

The precise period of time at which the shock took place at San Francisco, between eight and nine o'clock, is determined by the stopping of a time-piece belonging to J. W. Tucker, whose rate of error was three seconds fast.[4]

The effects were felt in San Francisco several hours before they are reported to have been observed at any other place north or south. They began here at twenty minutes past eleven, on the night of the 8th, and continued till thirteen minutes past eight

the following morning – six shocks occurring in the interim; while to the south, the first shock that was noticed at the Tejon was at 6 hours 30 minutes, on the 9th. In Los Angeles they continued at long intervals through the day until 23 hours 30 minutes of the same date. I have learned from persons who were present in Los Angeles at this time, and also at the shock of the 14th July, 1855, that the severity of the latter exceeded that of the 9th January last past.

Notes

1. Much of this paper deals with the reported times for the earthquake. These were not corrected to a single meridian, and some were very inaccurate: for example, that for San Diego was from Andrew Cassidy (see 3, n. 2).
2. The similarity of this and the account in the *Sun* is obvious. Trask has added a detail, that answers were not returned in two cases, which indicates that he was not simply using that article as a source. He may have talked to someone at the *Sun*, or may himself have been the source of their information.
3. Again Trask's account is nearly that of the *Sun* (49), but with an added detail. It should be noted that he makes the main shock weaker than the foreshocks (at least in San Francisco), while the *Sun* says just the reverse. The latter is more likely to have been right, as most of the foreshocks were not mentioned by most of the San Francisco accounts.
4. In an accompanying table this time is given as $8^{h}\ 13^{m}\ 30^{s}$ A.M.

56. Stockton *Daily Argus* January 10, 1857 p. 2, col. 1

A severe shock of an earthquake was felt in this city at about 8 o'clock, yesterday morning. It continued about fifteen seconds, and in many parts of the city was so violent as to produce a clattering of windows, swinging to and fro of hanging lamps, and causing a succession of quick movements which were anything but agreeable to those who experienced the feeling of dizziness which followed them. In the eastern portion of the city the shock was observed more distinctly. We learn of an instance in which a gentleman was thrown from his feet from the effects of the earthquake; and a number of instances in which people were compelled for the moment to suspend work. The shock was probably the most severe of any that has ever visited this city.

57. Stockton *Daily Argus* January 16, 1857 p. 2, col. 1

We learn from Mr. Canaday, who arrived in this city yesterday in charge of an express from Fort Tejon, that the earthquake which was felt in this city on the 9th inst., was remarkably severe at that place. A light shock was observed in the morning at about 6 o'clock[1] which was scarcely perceptible. At about 8½ o'clock, a second shock occurred which lasted from three to five minutes, and resembled in sound the rumbling of a train of cars. Nearly all of the buildings in the vicinity were seriously injured by the falling of chimneys, plastering, and walls. Several adobe buildings in course of erection and nearly completed were almost totally demolished. Fortunately, they were unoccupied, although the roofs were on and the work upon the interior nearly finished. Several narrow escapes occurred at the Fort. A man in the kitchen of one of the adobe buildings succeeded in making his escape from the door at the moment the walls fell in. Had he remained in the building a moment longer, his life would have been the forfeit. Dr. Tenbrock, at the Fort, was violently thrown from his feet.

At the government mill, which supplies the lumber for the Fort, situated about twenty miles beyond, the mules employed in hauling timber were thrown down, and the mill, for the time, was abandoned. Branches of trees were broken off, and large oaks fell to the ground.

At Reed's Ranch, a Mexican woman was killed by the falling of an adobe. — Several large buildings in the neighborhood were very much injured. About a mile above the Fort, a little girl came near to losing her life by a limb which fell from the effects

of the shock. Rev. Mr. Bateman, riding through the country about twenty miles distant from the Fort, states that in many places upon the road, the earth is upheaved, and exhibits the appearances of a very violent shock. He was informed by a vaquero that at a point still further in the mountains the roads have become almost impassable.

At Kern Lake, the water in the river was forced back, and rose over the banks about four feet. Mr. Canaday informs us that through information obtained along his route to this city, he is satisfied that the force of the shock was gradually less as it approached northward. At the Fort, no one was injured and no accident occurred, beyond the falling of houses and trees. Shocks were felt throughout the day at short intervals, which kept the people on the qui vive, expecting every moment more serious results. From the accounts detailed by Mr. Canaday, we are confident that the shock was more severely felt at Fort Tejon, than at any other point in the state. The damage done will require much time and expense to repair.

Notes

1. In his statement to the *Republican,* Mr. Canaday gave this as 6:30.

58. Stockton *Daily Argus* January 19, 1857 p. 2, col. 2

Visalia, Jan. 9th, 1857

EDITOR ARGUS — Sir: This morning about sun-rise a slight shock of an earthquake was felt at this place. Fifteen minutes after 8 o'clock a very severe shock was felt which lasted for a number of minutes. I have heard various estimates of its duration but all agree that it lasted between ten and twenty minutes.

At first, a slight rumbling of the earth, which lasted for about two minutes, when the earth began to heave and roll like the waves of the ocean — so much as to make it very difficult to remain on the feet. This continued for several minutes, when a deep rumbling sound was heard, as many describe it, like the sound of distant thunder, but my ear sounded like the grating together of immense rocks. The rolling of the ground under us was seen as distinct as the waves on the ocean. I cannot describe it more definite than to compare the motion of the earth to the waves of the ocean after a storm.

The tree tops vibrated back and forth for several feet. The water in the streams was dashed from bank to bank, throwing it several feet out of its level.

The vibrations were from North-East to South-West. I have seen gentlemen from

White River, fifty miles South-East of this, also about the same distance North of this place, and they give about the same accounts that I have here given. I have also seen persons from near Tulare Lake, who say the shock was severely felt there, and three miles from the Lake they could distinctly hear the dashing of the waves.

Slight shocks have been felt during the day and evening. At fifteen minutes of 9 o'clock at night, a slight shock — at twenty five minutes after ten, a slight shock — followed in a few minutes by quite a severe one. No damage has been done as we can learn. Should I be able to gather any more particulars in reference to this matter, I will forward them by the first opportunity. Respectfully,

TULARE

59. Stockton *San Joaquin Republican* January 10, 1857 p. 2, col. 1

Many of our citizens experienced a severe shock of an earthquake yesterday, at about twenty minutes past eight o'clock A.M. By all we can learn, the commotion was very visible, lasting some minute or two. We have heard two or three gentlemen describe the sensation as being so violent as to cause a kind of sea-sickness. In our establishment, the shock was quite apparent. The lamps, which are suspended from the ceiling, swung to and fro for a distance of more than a foot. One of them was thrown against the wall so violently that its jingling was heard in every part of the office. One gentleman informs us that he felt a shock similar to the one mentioned above, about six o'clock, but being engaged out of doors at the hour first named, he did not feel it at that time. If his statement is correct, there must have been two separate shocks, at 6 and 8 o'clock. If this quaking was felt in San Francisco, proportionably more severe than here, as has usually been the case, we may expect to hear of some damage being done.

60. Stockton *San Joaquin Republican* January 11, 1857 p. 2, col. 2

We are informed by a gentleman who was on a hunting excursion on Friday morning last, that he witnessed a very singular phenomenon, which he describes about as follows: He was standing on the bank of one of the little lakes which are found in the tules, watching for ducks. All at once he heard a rustling in the water, resembling the noise that would be made by animals wading through a shoal. His attention being

called to the peculiarity of the noise, he stood watching for a few moments, when a large swell came rolling and dashing violently against the shores, and in places running out over the plain to the distance of several hundred yards. The bank where our informant stood, was covered by the swell to the depth of two or three feet. The swell seemed to roll northward, as though the centrifugal motion of the earth had momentarily ceased. In a short time the waters settled back and again became placid. This phenomenon occurred in the morning about the time the earthquake was felt in this city.

61. Stockton *San Joaquin Republican* January 16, 1857 p. 2, col. 1

From Mr. Canaday,[1] who arrived in this city yesterday afternoon from Fort Tejon, we learn that the earthquake which occurred on the 8th inst., was felt in that vicinity with great severity.

The first shock, which was very slight, and barely perceptible, occurred at 6½ o'clock in the morning, and second at 8½ o'clock. The second lasted from three to five minutes, throwing down some of the walls of unfinished adobe houses, and prostrating most of the chimneys in the vicinity of the Fort. Limbs of pine and other trees, many of them four feet in circumference, were broken off, about twenty miles to the southward of the Fort; chasms and fissures were also made in the earth, in the same vicinity. Mules and other animals were thrown to the ground with violence. A house on Reed's Ranch, six miles from the Fort, was leveled with the earth, and a Mexican woman, an inmate, killed by the fall. This is the only instance of any one known to have been either killed or injured.

Up to the time our informant left the Fort, — Saturday morning — slight shocks were felt with more or less frequency. No indications of an earthquake were observed during the trip to this city.

Notes

1. This article, being drawn from Mr. Canaday's statements, is not independent of (57), which is the more full account.

62. Sacramento *Age* January 9, 1857 p. 2, col. 1

About twenty minutes past eight this morning, an earthquake was very sensibly felt throughout the city. The vibrations were from east to west and of sufficient violence to create general alarm, many persons rushing out into the streets. We have heard of one or two instances of hardware, crockery and light articles being thrown from the shelves. On J street the second story walls of a brick building were cracked and a chandelier thrown down and broken. Further than this we know of no actual damage, though there are many rumors of such being the case.

63. Sacramento *Age* January 10, 1857 p. 2, col. 1

We have information of severe effects of the earthquake, along the line of the lower Stockton road. Below Benson's Ferry,[1] the waters of the Mokelumne river, much swelled by recent rains, were thrown over the banks, leaving the bed of the stream almost bare. Houses were shaken violently, destroying articles of glassware, and overturning furniture. Limbs were broken from trees, the trees in some instances settling down two or three feet into the ground.[2] The inhabitants of that section were terror stricken, whilst dumb brutes appeared to be paralyzed. We look with interest for further details of the occurrence and expect they will prove this to be the severest commotion experienced in the country since it has been inhabited by Americans.

Notes

1. This was about 500 meters west of the junction between the Consumnes and Mokelumne Rivers (Hoover *et al.*, 1966, p. 374). We have assumed that the rest of this report refers to the area between Stockton and Sacramento.
2. Possibly an effect of liquefaction.

64. Sacramento *Daily Times* January 9, 1857 p. 3, col. 1

The shock of an earthquake was sensibly felt in this city at ten minutes past eight this morning. The waters in the Sacramento river heaved and swelled so as to make the hulks rocks at their moorings as though a squall had struck them. The statuary in the telegraph building swayed to and fro — the roof of the Catholic

Church creaked as if in pain — the gas pipes in the Orleans sent forth jets of water — one of Cheap John's houses cracked a little, and other houses throughout the city, felt the shock very sensibly, but no real damage was done so far as we have heard.

65. Sacramento *Daily Union* January 10, 1857 p. 2, col. 4

The vibrating motion incident to an earthquake was observed distinctly, though slightly, in this city about 2¼ A.M. yesterday — more sensibly at 10¼ A.M. and again, slightly (we are informed) at 10:20 P.M. The shock at 10¼ A.M. created some consternation in many localities, although in others it was wholly unnoticed. It was but of a few seconds duration, but sufficient in force to cause chandeliers to vibrate about a foot from the center, to create a rattling among the crockery and other wares of our dealers, to rock several of the hulks at the levee and impart to many a sense of motion produced by some general unseen cause. The clocks in the banking houses of Drexel, Sather & Church and D. O. Mills & Co., and in the Magnolia and other places, were stopped; a seam about a quarter of an inch in width was opened in the plastering in a new brick building on J street, between 7th and 8th streets, and portions of the plaster thrown down upon the operatives at work in the room; and many persons being unable to appreciate the causes of their sensations at the movement imagined that they were attacked with vertigo, and in instances called for and applied restoratives. The motion seemed to be from east to west like successive undulations. The phenomenon has not been observed in this locality since 1851.

66. Sacramento *Daily Union* January 10, 1857 p. 2, col. 5

There can be no doubt but that a considerable shock of an earthquake was experienced in this city on Friday about 8 A.M. There were, as far as we can ascertain, three distinct vibrations, which seemed to proceed in a direction from south-east to north-west. The shock was perceived by a large number of our citizens, and so evident was it, that its nature was instantly recognized, as some even rushed out of their houses. We have heard of clocks being stopped, doors and lamps set swinging, and it is reported that the walls of the Catholic Church have been cracked.

67. Sacramento *Daily Union* January 12, 1857

The different accounts given of the shock of the earth felt on Friday morning last, January 9th cannot but be of interest to the reader, although some of them, we must confess, appear to be tempered by the temperament of individuals. An excessively nervous man would, of course, feel the shock much more distinctly than one less so; whilst others possessing an extremely fertile imagination, will have seen wonderful things, which in all probability a matter of fact man would have been unconscious of. We, however, give the different stories, leaving them to stand upon their own foundation.[1]

The *American* of yesterday remarks:

A gentleman from Mokelumne Hill informs us that it was severely felt in that region, and seemed to shake the hills for miles around. Reports were numerous of the caving in of several tunnels and the burial of a number of men, but he could not obtain the particulars.[2]

Notes

1. We have reprinted only one account, for which the original is not available.
2. The last phrase suggests that the reporter could not confirm this account. It is not confirmed elsewhere, and is contradicted in (50) and (51). We have therefore chosen to reject it as false.

68. *State Year Book,* 1857 (Langely and Mathews, 1857, p. 36)

The undulatory motion was very sensibly felt at Sacramento City. The Orleans Hotel seemed to rock to and fro, the chandeliers in the halls took on the same motion, while the water in an artificial pond in the yard was observed to oscillate with considerable force from side to side.

69. Marysville *Herald* January 13, 1857 p. 2, col. 2

On the night of Thursday and the morning of Friday last, several shocks of an earthquake were felt in San Francisco, Sacramento, Stockton and also slightly in this city.

70. Sacramento *California Farmer and Journal of Useful Sciences*
January 9, 1857 p. 4

A severe shock was felt at Sacramento this morning, at eight o'clock and five minutes. We were writing at the time, and the sensation was so strange as to startle us. The building (a fire-proof brick) rocked like a ship affected by a ground-swell, swaying to and fro. The pendants upon a candelabra rattled together, and pictures upon the wall swung and moved the same as on board ship. The movement lasted two to three minutes, and was in three distinct, heavy rolls, although continuous. The shock caused a like sensation to sea sickness, in some persons. The vessels at the Levee were moved the same as by the rolling of the sea, although there was a perfect calm. No damage has been announced to the hour of our going to press.

71. San Francisco *California Farmer and Journal of Useful Sciences*
January 16, 1857 p. 5, col. 1

The earthquake was felt very sensibly at San Jose, and in all Santa Clara Valley, and its effects upon the artesian wells was most singular. The well at the beautiful cottage of Col. A. J. Grayson rose some twelve inches above the usual flow, and then fell suddenly as much below — rose and fell several times and then resumed its usual current. The first well sunk, near Smith and Winchell's, which had flowed but slowly of late, ceased altogether. Another, at Guild & Brown's, was stopped. Several others rose and fell. The great well in the city suddenly ceased its flow and now barely runs. We have heard of other strange pranks, both on earth and in the water. We shall note further these results.

72. Sacramento *Daily Union* January 12, 1857 p. 1, col. 7

Several shocks of an earthquake were felt last evening and this morning in this city.[1] The greatest vibration occurred a little before eight o'clock this morning. There is a great diversity of opinion among our citizens as to the extent of the motion of the earth produced by the affair at the time last mentioned. Many people were ignorant that we had again been visited by an earthquake; others felt the shock very slightly; and other still were much frightened at the extent of the

vibration. A gentleman who resides in Happy Valley,[2] the southern portion of the city, informs me that most of the people in his vicinity left their houses in alarm, and that he was nearly thrown from his chair. The shock was the most severe in the lower part of the city, and the crockery and other wares in some of the stores down town were considerably shaken up, although I heard of no damage being done. In the upper part of the city and on the different hills the inhabitants were hardly conscious that anything unusual had occurred. The vibration was from east to west. The occurrence to-day was slight in comparison to that which took place in February last.

Notes

1. San Francisco: this is a portion of a letter from the San Francisco correspondent of the *Union*, dated 3:30 P.M., January 9, 1857.
2. According to the map on page 20 of Soulé *et al.* (1855) this was the area along 2nd Street, between Mission and Howard.

73. Reminiscence of Mr. Bell, c. 1905 (As retold by geologist Harry R. Johnson, in a letter to H. O. Wood, May 22, 1944; text here taken from Wood, 1955, p. 63)

A year or so before the 1906 San Francisco earthquake I learned that a Mr. Bell had experienced the 1857 disturbance whilst herding cattle in the Cariso Plains. I visited Bell in Bakersfield and he informed me that at the time of the earthquake he and a couple of other men working with him thought at first that the disturbance was due to a stampede among the cattle. According to Bell the earthquake occurred in the early morning hours, before daybreak, and when it became light enough he and his helpers started a search for their cattle, which of course had been badly frightened. Bell noticed considerable dust in the air along the foot of the Temblor Range and assumed it to have been raised by his stock on the run. It is possible of course that this may have been due to fine material thrown into the air along the rift at the moment of displacement.

The outstanding statement made by Bell to me was that an old fashioned round sheep corral, apparently located directly upon the rift near the southeastern end of Carriso Plains, was dislocated in such a way that it made a rude S-shaped figure, which would imply a movement horizontally of several feet.

I was very doubtful as to the accuracy of Bell's statement at the time he made it, but a year or so later, after the 1906 earthquake, I saw plenty of evidence along

the San Andreas rift south of San Francisco of a sort which convinced me that the statements by Mr. Bell were to be trusted.

74. Portion of a letter from Ellen Pratt McGary to Ellen Spencer Clawson, San Bernardino, January 9, 1857 (Ellsworth 1974, p. 35)

Friday morning 9th

We have just had quite a severe shock of an earthquake. We are hardly done shaking from the effects of it. What frightful sensations it gives one to feel the earth shaking under ones feet, not knowing one second what will happen next, expecting every moment to see the houses fall or perhaps the earth open and swallow you up. If you ever saw pale faces you would have seen them this morning. it made me think of a great ship rocking on the sea, it lasted more than a minute, the trees shook as if in a strong wind, the water in the well splashed against the sides, the walls of the houses creaked, and folks staggered as if they were a "little bit tight," but there was not material damage done I believe and I realy do hope such shocks may not be frequent

75. Santa Cruz *Pacific Sentinel* January 17, 1857 p. 2, col. 5

On the morning of the 9th there were three earthquake shocks. The first was felt about 4 A.M., and was quite severe, causing buildings to tremble considerably and accompanied with a noise resembling a heavy wind. A second was felt a few minutes before 7, and was not as severe as the first or third. The third took place about 7-1/2, and was so severe that clocks were stopped, cradles and chairs set in rapid motion, and the undulatory motion of the earth caused many to feel dizzy, a cracking and shaking of buildings, waving and bowing of trees as if by a heavy wind. I am not fully satisfied as to the direction of the wave.

76. Santa Cruz *Pacific Sentinel* January 24, 1857 p. 2, col. 2

A shock of an earthquake was very seriously felt on Tuesday morning last, it was not so severe as that of the 9th inst., though our store keepers say it caused a general rattling among their crockery ware.